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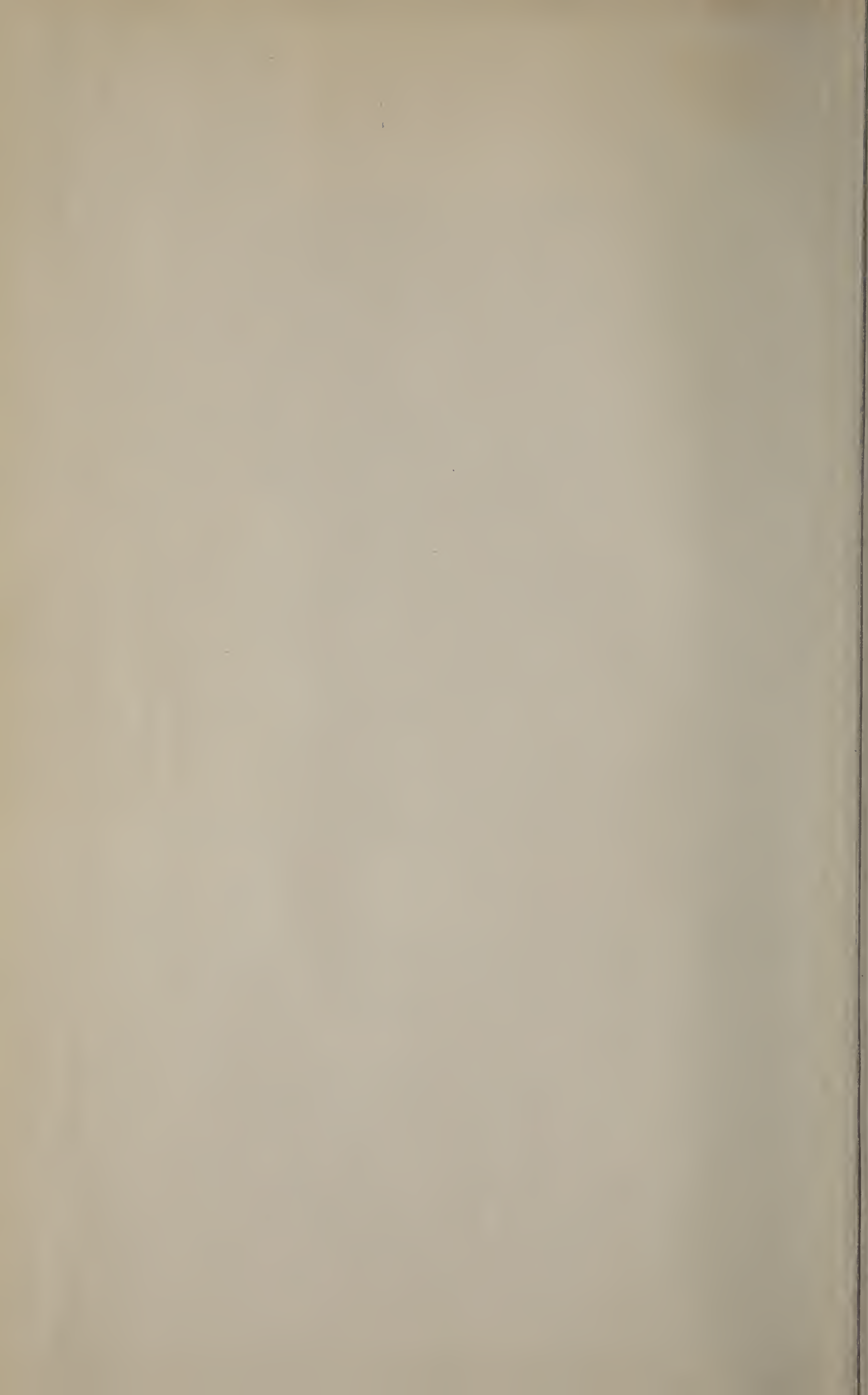
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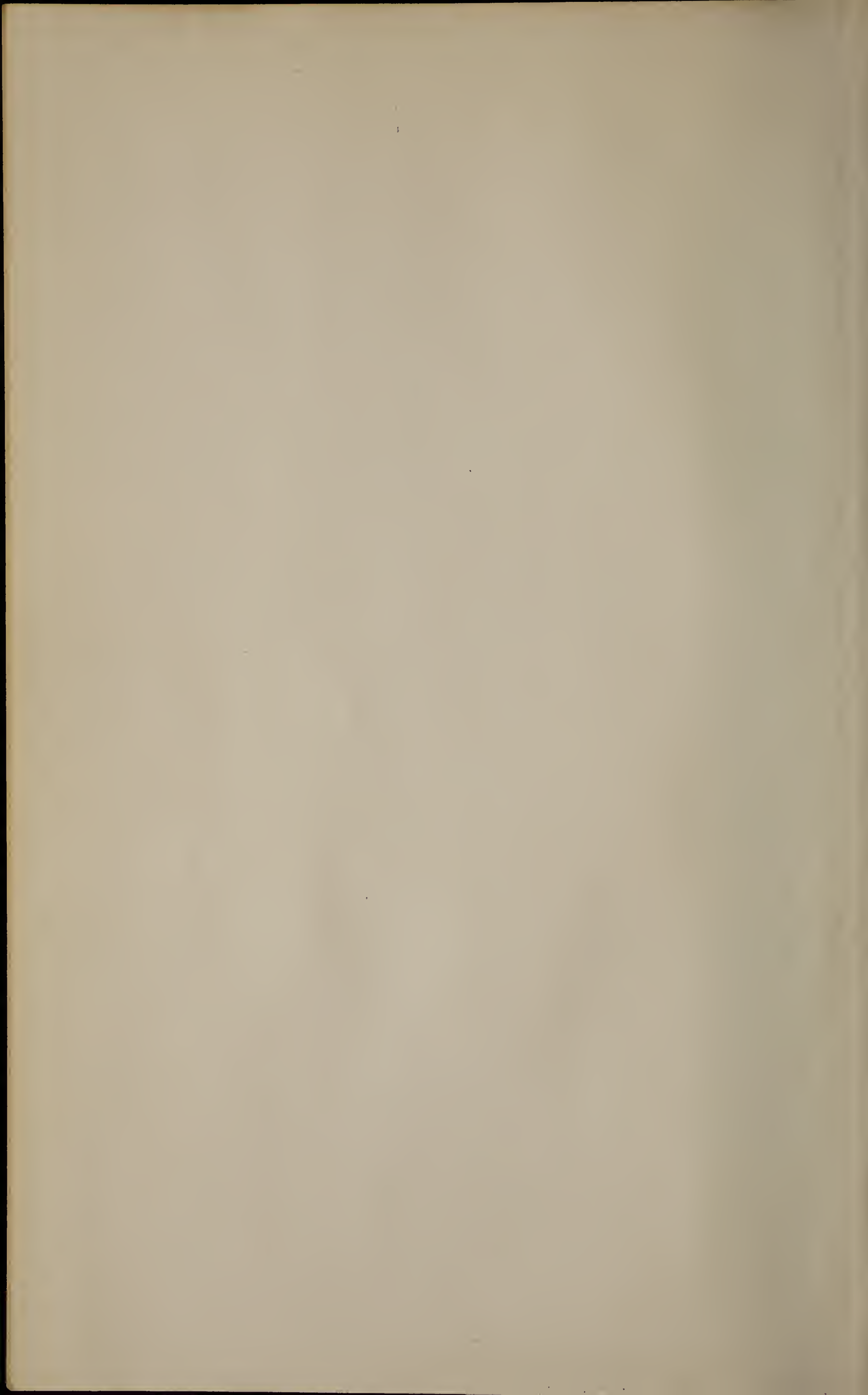
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THE STORY OF AN ANCIENT ART









*Frank G. Perkins*

# THE STORY OF AN ANCIENT ART

From the Earliest Adhesives to Vegetable Glue

By

FLOYD L. DARROW

Author: *Masters of Science and Invention,*  
*The Story of Chemistry,*  
*The New World of Physical Discovery, etc.*

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BLACK GOLD

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*In Memory of Frank Gardner Perkins, on the  
twenty-fifth anniversary of his invention of Vege-  
table Glue, this book is presented to the general  
public and in particular to that host of friends  
whose cordial coöperation has made possible this  
quarter of a century of progress.*

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## CHAPTER I

### *In the Workshops by the Nile, and Before*

THAT so prosaic a subject as glue should be associated with art, the idealistic expression of the creative spirit of man, may seem to make extravagant demands upon our powers of imagination. What is there of beauty in the unsightly glue pot? Or what suggestion of sentiment can possibly attach to the foul-laden odors emerging from the ancient glue room? Are there any great names among the devotees of the time-honored practice of employing an adhesive to make a perfect joint? Why speak of art and glue as having anything in common? Art breathes of the divine in man; glue was long a product of ill-smelling waste.

Did you ever see the Great Pyramid, rising four hundred and fifty feet above the Nile? By some unknown combination of levers and planes, one hundred thousand men through a period of twenty years lifted the mammoth blocks into position. Across the centuries that intervene this mighty monument, even today, speaks of the infinitude of human toil. We see the pyramid and are prone to forget the picture of the successive armies of slaves who, under the lash of the whipmaster, built it, stone on stone, until it almost pierced the sky. In that day, the flesh and blood of



the bondman were indispensable to the erection of this imperishable challenge to the ravages of time. So, too, of those colossal temples of polished granite, the tombs and great public edifices, eloquent memorials to a genius for art unsurpassed by any other people of antiquity. Human drudgery was the matrix out of which they grew. Without it the soul of ancient Egypt could not have found expression.

*Glue is  
indispensable  
to the artist  
and master  
craftsman*

Likewise of glue. Down through the centuries the artistic creator of beautiful designs in furniture and architecture and the master craftsman have been slaves to the unique properties of glue for the preservation of their work. As indispensable as the mortar that binds together the brick and stone of a noble edifice is glue in the ancient art of veneering. Indeed, this art would have been impossible without it. Its humble utility is written large in the masterpieces of craftsmanship which through its aid have escaped decay. Its commonplace rôle has proved to be a factor of strategic importance in resistance to destruction. Yet, like the modest soldier in the ranks, it has been content to serve unnoticed rather than to share conspicuously in the glory of great triumphs. Still, there is romance aplenty associated with the art which it has made possible and from which it can never be separated. Born in the gray dawn of antiquity, following a thousand pathways along the upward climb of man's journeyings, preserved from







*A veneered mummy case, now in the Metropolitan Museum of Art, made everlasting by the use of glue*



utter loss during the long black night of medieval eclipse, this growing knowledge of adhesives has been the friend of genius and the faithful servant of great artists. Yes, to speak of glue as contributing vitally to an ancient form of artistic expression is both figuratively and literally true.

And what ground may there be for calling this an ancient art? Before me lies a line drawing of a mural record found in the sculpture of Thebes and dating from the time of the third Thothmes. As clearly as though this faithful representation of early artistry might have been made yesterday, we see the glue pot on the fire with the end of a stirring rod projecting. A workman, brush in hand, is applying glue to a wooden base. Another is apparently fitting a piece of thin wood, presumably of some rare quality, to a core of ordinary material. An adze, carelessly fixed in a block of the same structure as the base, indicates its more lowly character. A veneered box, a finished product of the art, is conspicuously placed.

The foregoing record is at least 3,500 years old. It is believed to date from the Pharaoh of the Exodus. The treasures, too, removed from the tomb of King Tutankhamen include many examples of wooden furniture bearing unmistakable evidence of having been joined and veneered with glue. Yes, glue and veneering breathe of the very essence of ancient art.

*The use of glue was old, even in the days of the Pharaohs*

Further, we know that a long and painful pathway must

have led from the first early experiments of primitive men in this field to the high degree of perfection displayed in the mural decorations of the monuments of the Nile Valley. In passing, let us try to visualize the record, imperfect though the picture may be.

Millennia ago, how many no one can say, we catch a glimpse of savage men, differing but little from the wild beasts about them, standing in awe and superstitious wonder before some chance fire kindled mayhap by the lightning flash or volcanic outflow. This marvelous manifestation of Nature, apparently wholly above their power to create or control, excites their fears and evokes their in-born sense of worship. Gradually, they discover the sort of materials upon which these fire spirits like to feed, and for centuries their knowledge of fire extends only to a means of perpetuating it. Then, one day, it dawns upon some primitive man's dull-witted brain that friction produces heat, the same sensation as that radiated from Nature's fires. He recalls many examples. He may have noted the occasional kindling of fires by the chance rubbing together of two dry branches in a strong wind. He deliberately seeks to duplicate the process. Ignominious failure meets his effort. He tries again, and yet again and again. Still, the fire spirit eludes him utterly. He cannot trap it. Others try with no better success. In that far-away period of leisurely progress, years slip by, and decades mayhap lengthen into centuries. And with it all come some small gains.



Eventually those blind gropers after a better way of living discover the sort of wood needed and the precise conditions necessary for success. Man comes into possession of the mastery of fire, the first great turning-point in the evolution of the race. The campfire before the open cave lures wild animals within his range. Over it he learns to cook his food, and before its genial glow he basks in winter. In the dry air rising from its embers he seasons and toughens the wood which he shapes into formidable weapons of warfare. As the centuries pass and the knowledge of fire grows, we see him master the arts of pottery, glass-making and the metallurgy of the simple ores. Civilization is on the march. The Age of Stone merges into the Age of Metals. Fixed homes, cultivation of the soil, domestication of animals and the rudiments of an organized society begin to dominate the picture. And sometime, somewhere, man pauses to look up at the stars. As naturally as the first twilight shadows of approaching dawn chase away the blackness of the night, a new-born sense of beauty awakes within his soul. The spirit of creative art, latent within his nature, begins to unfold. In that moment, a thousand masterpieces are potentially born. Man has ceased to be a mere animal. He has become a creator.

*Primitive  
men attain to  
the mastery  
of fire*

All this and much more had to precede the record of the skilled artisan revealed in those drawings on the walls of ancient Thebes. How slow was the progress, we cannot now conceive. Well might we liken it to the slow wearing

down of a continent by the action of natural forces. Or, better still, to the work of coral polyps, as the infinitesimal growth of their skeletal framework lifts an island above the ocean's waves. But just as irresistible as is either of these natural processes was man's upward climb from beast-like savagery to a mastery of the simple arts.

Just when men began to build homes, to provide them with simple articles of furniture and to decorate their walls with rude pictures, no record discloses. We do know, however, that the Cro-magnon men, who occupied the caves of Europe some twenty thousand years ago, had developed the æsthetic sense and the skill of artistic expression to a high degree of perfection. They were the real cavemen and the first of the present species of the human race. Numerous carvings and paintings on the walls of those primitive dwellings, as well as statuettes and works of sculpture, tell us of their love of the beautiful. In one instance, the tusk of a mammoth, bearing a sketch of the animal itself, scratched upon its surface, proves that a race of men with the skill to draw roamed the earth at the same time as did that now extinct beast. Professor Henry Fairfield Osborn, Director of the American Museum of Natural History, asserts that the standards of art of Cro-magnon men were the equal of those of the present day.

*Adhesives,  
a product  
of artistry*

Out of this slowly developing skill in artistic expression grew the necessity for adhesives. With the acquisition of



metal tools, arising from the application of fire to the working of the simple ores, came the possibility of shaping wood to meet the necessities of primitive industry and to minister to man's sense of comfort. Just how the first articles of furniture were fastened together, we do not know. Doubtless many of the earliest ones were fashioned in a solid piece. When less simple forms began to be built, leather thongs may have been employed to hold the separate parts in place. Mortising is a very old art. The very name carpenter and joiner, which goes back to earliest times, shows that skill in joining members of a structure together has always been regarded as an essential part in the materialization of architectural designs and in the building of furniture. Sometime, so long ago that no possibility exists of ever being able to fix with any certainty even the approximate date, it occurred to some artisan that an adhesive, which would set and grow strong with age, might make an ideal joint. In that moment the real story of glue began. The foundation had been laid. The necessity had arisen. Further progress in the art of construction demanded this next innovation. It must be forthcoming, and it was.

By what slow and tedious experiments, research we call it now, those early pioneers, living long before the time of the Pharaohs, learned how to make a glue that would meet the requirements of their art, we can only guess. Certain it is that this knowledge did not come with a bound. It did

not drop from the clouds. It was not a gift of the gods. Beyond question it came because a succession of far-seeing men, dreamers we might call them, had the vision, the persistence and the scientific skill to work on and on, following a thousand trails, many of them leading into blind alleys, time and again baffled but never defeated, until success perched upon their banner. Considering the time at which this search was made, the later quest of the alchemist may not have seemed more bold or elusive. In any case, when the curtain of recorded history lifts upon ancient Egypt, the gateway through which all arts were transmitted to the world, we find a practical knowledge of the use of glue firmly intrenched in the workshops by the Nile.

*In the  
workshops  
by the Nile*

What sort of materials the Egyptians used in the preparation of their glue the record does not tell specifically. That they melted it over a fire, spread it with a brush and held the glued parts down with stone cauls, weighted with bags of sand, mural drawings show. From these facts it would seem that the glue of that time was similar in character to the animal and fish glues of today. On this point *The Story of Furniture*, translated from the German by A. Koeppen and C. Breuer, contains the following:

“The ancient Egyptians already employed the art of ennobling an ordinary wood by gluing on thin layers of costly woods. For example, the corner posts of a large mummy case now in the Berlin Museum are overlaid with a veneer

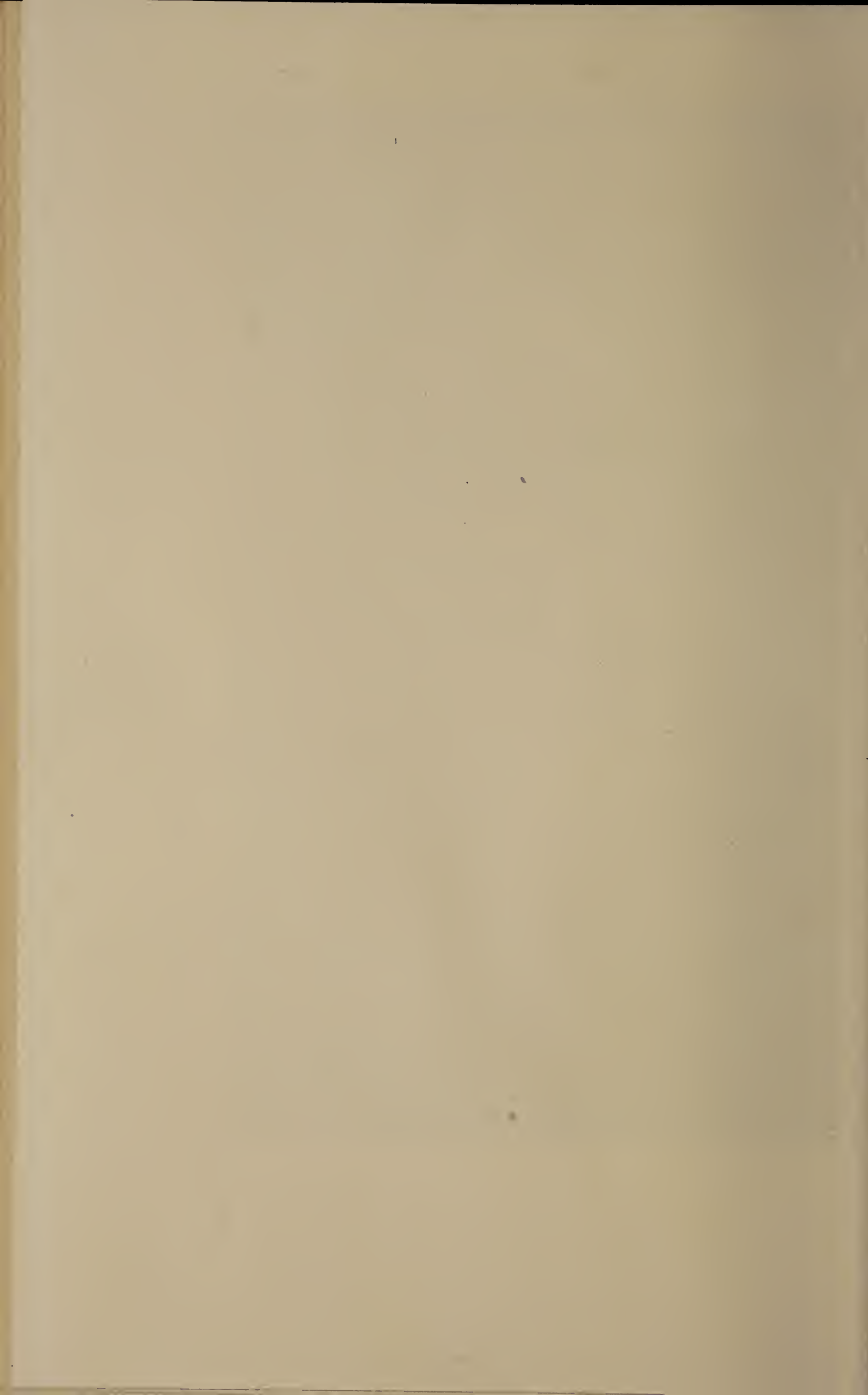




GOLD, BY M. TOURRIER

*The quest of the alchemist may have been little more elusive than that for a practical adhesive*





almost one centimeter thick.

“Glue was a favorite fastener. There were two kinds of glue, the common kind, joiner’s glue made from animal offal and fish bladders—and also the glue made from caustic lime and white of egg or casein, which had already been discovered by the Egyptians.

“Their wish to construct rich furniture at lower cost, as well as the experience that the use of a suitable core-wood makes flat pieces warp less than when heavy boards of costly wood were used, led them to adopt ply-work. This was cut with saws and fastened to an under layer of other wood with glue. They made table tops, chests, beds, etc.”

Of what long centuries of previous discovery this passage speaks! Veneer, glue of two distinct kinds, saws, ply-work, articles of furniture, standard to the present day. This seems almost like a description of modern artistry. And yet the abundant evidence of veneered furniture brought to light by the excavations of historical research leaves no room for doubt as to the accuracy of the picture. Indeed, the common practice in those ancient times included inlays of precious stones, gold and ivory, and veneers of rare woods. Plywood, built up by gluing together thin sheets, or plies, was well known.

As everlasting as the pyramids themselves, this Egyptian handiwork has proved to be. Wood sawed in some unknown manner into thin layers and glued to a heavier base has survived the vicissitudes of nearly four thousand years. Surely,

rare skill was at the command of the Pharaohs in that far-off time. As one has put it, "artistic feeling and the skilled hand more than compensated for inferiority of tools."

*The  
Pharaohs  
go abroad  
for rare woods*

As the centuries brought prosperity and wealth to the rulers of the fertile valley of the Nile, there came also love of luxury and a delight in beautiful surroundings. Wood had long been recognized as the ideal material from which to fashion graceful furniture. But wood suitable to the purpose was not abundant in that land of little rain. However, this lack was no obstacle to the imperial desires of the Pharaohs. Rare woods—ebony, and probably rosewood and teak—were imported from India. As dynasty succeeded dynasty and the love of grandeur grew, it was discovered that beautiful furniture could be fashioned by gluing a veneer of richly figured wood to a core of ordinary material. Furthermore, this method gave added strength and durability, as well as conserving the supply of costly woods.

Perrot and Chipiez, in their *History of Art in Ancient Egypt*, give the following picture of royal furnishings: "The interior of an ancient Egyptian house must have been very different from the bareness which greets a visitor to the modern East. Chairs with or without arms, tables of varied form, folding seats, foot-stools, brackets, supporting vases of flowers, cabinets, in which objects of value were locked up, filled the rooms. The upper classes of Egypt lived a life that was refined and elegant as well as civi-



lized. A great lord of the time of a Thothmes or a Rameses was not content, like a Turkish bey or pacha, with a divan, a few carpets and a mattress, which after being locked up in a cupboard during the day are spread upon the floor for his accommodation at night. He had his bedstead, often inlaid with metal or ivory, and, like a modern European, he had other articles of furniture."

Historical research shows that the rich beauty of much of this furniture would have been wholly lacking had it not been for a mastery of the art of veneering. And in this ancient form of artistry, glue holds the key position. Those thin layers of priceless woods, brought overland at great cost, would have been wholly useless for their purpose without a practical knowledge of adhesives.

Therefore, when we invite the reader's attention to the humble subject of glue, it is to unlock for his imagination a treasure-house of vast riches. And, as for romance, what could not these art treasures of the ages tell of love and intrigue, of royalty and war, were they but able to speak of the many events and scenes which they so intimately witnessed amid that living, throbbing, pleasure-loving civilization of antiquity?

*A tale of  
art and  
romance*

Let us not imagine, however, that with that ancient civilization, now forever gone from the scene of world action, glue had more than begun to assume its rôle of manifold usefulness.



---

## CHAPTER II

### *Veneering, Through the Centuries*

IN imagination I stand in King Solomon's Temple. I travel backward along the fourth dimension of time nearly three thousand years and find myself in another world. Vanished, as though by magic, are the seething, struggling throngs of business-maddened humanity of this twentieth century of modernism. I am in the midst of another "modernism," as real, as vital, and as promising as any that has succeeded it. I am moving with the very vanguard of the westward march of civilization. Europe is yet in the unrestrained possession of savagery; the power of Carthage is not even a dream, while the "glory that was Greece and the grandeur that was Rome" are in the distant future. Behind me lie the traditions of proud peoples and vast progress, hoary with age,—Egypt in the seemingly far-off Valley of the Nile, Babylon and Assyria by the Tigris and the Euphrates, and India and China stretching away into an antiquity of unknown extent. Will the future ever again see such triumphs as Solomon, in the midst of his glory, surveys? His temple is the wonder of his world. It breathes of science and invention, of mechanical perfection, of art and beauty. What craftsmanship, what furnish-

ings, what lines of graceful symmetry, what rare treasures!

I look about me. Here are "Cedars of Lebanon," famed *In King Solomon's Temple* in the traditions and poetry of the East. Posts of the fir tree, upon which are carved open flowers, overlaid with gold, cherubims and palm trees, greet my eye. Furniture of ebony, teak and Indian walnut, inlaid with ivory, abounds. A bed of cedar wood, with pillars of silver and a golden bottom, speaks of the luxury which the king of a people, risen from slavery, can command. And there is the "great throne," rich with the majesty of ivory and overlaid with the "best gold." Inlay and veneering are conspicuous features in the decorative designs of furniture and architecture, for through the gateway of the Tigris and the Euphrates this art has been transmitted to the Hebrew people. Or, mayhap, they in part carried it with them when they escaped from bondage.

The age of machinery lies so far in the future that it has not even become a dream. The skilled artisan reigns supreme. The world waits upon his craftsmanship. It is he who must fashion into tangible forms of truth and beauty the ideas born of the artist's genius. A living flame, arising from an almost divine sense of creatorship, gives him inspiration and directs his hand and eye. He glories in his work, proudly conscious of his strategic importance in giving material expression to artistic designs. Often he is both artist and craftsman in one, in literal truth bringing his



dreams to pass. Without knowing it, he is a chief factor in bringing about the progress which we call civilization. In those leisurely times, he builds a thing from the ground up. He is the complete master of his art. Piece-work is unknown. Step by step, he sees his idea take form. Just as the artist puts the glory of a thousand sunsets upon his canvas, or the sculptor brings to life the god-like figure imprisoned in a block of marble, so does this inheritor of long ages of slowly acquired skill work his pleasing effects in furniture and architecture. The man who merely tends a machine has not yet been born.

It is a snug world in which I find myself in this land of Nineveh and Judea in the time of King Solomon. Although surrounded with savagery, as the stars of heaven with the vast reaches of interstellar space, these focal spots of civilization seem to be ancient. Barbarism lies in the dim, distant past. Wealth has followed man's subduing of Nature, and with its accompanying leisure have come an appreciation of art and the love of luxurious surroundings. Furniture must be beautiful as well as comfortable and useful. The rich heritage of practical skill and knowledge, slowly accumulated through the preceding millennia, provides the means for the gratification of these unfolding desires. All seems well with the world, and the Temple of King Solomon stands as a mighty monument to the stability of the present and as a glorious symbol of future progress. How great that progress was to be, no man could foresee.

Now, it was in this very love of beauty that the art of veneering was born. Solomon did not cause his artisans to inlay the furniture of his magnificent temple with ivory, precious stones and gold and silver, or to veneer it with thin layers of rare and beautiful woods, from any sense of economy. Neither did the Egyptians nor the Assyrians and Babylonians before him. Enhanced beauty was in every instance the dominating motive, and, despite a somewhat widespread idea to the contrary, it has continued to be so down to the very present. To trace the art of veneering through the centuries is to follow the historical evolution of furniture in its varying forms of style and beauty, or sometimes ugliness, as period has succeeded period. The development of veneering, and with it the story of glue, is part and parcel of one of the most significant streams of progress in the history of human artistry. Let us see, somewhat, whither this ages-old quest has led its devotees.

*The art of  
veneering  
springs from  
a love of  
beauty*

For many centuries, the pressure of expanding populations and the military and political sway of empire urged the dominant peoples of the earth ever westward, in search of larger boundaries and new sources of natural wealth for exploitation. The sea-faring prowess of Ancient Phoenicia has become a tradition. Her intrepid adventurers pushed their tiny craft even beyond the "gateway of the world" and planted the seeds of future centers of commerce and industry in far distant ports. In time came wealth and with

*Art  
marches  
westward*



it, as in the proud cities of antiquity, the love of the beautiful and the cultivation of artistic tastes. Over and over again in this westward march of armies and traders, the process has been repeated. First the military conquest, then political and commercial domination, finally to be touched by the softening influences of the growth of art.

And let it be emphasized that in this expression of art one sees reflected the spirit, the history and the traditions of nations; likewise, the moods, the thought, the purposes and the mental atmosphere of a period. Nowhere else is this truth so well portrayed as in the changing fashions of furniture. No other form of art is so intimately associated with the lives of people. Articles of furniture come into one's life daily. In their evolution from century to century, they tell a story as complete and significant as the fossil record of extinct animals has written regarding the early geologic history of the earth.

*Veneering  
in ancient  
Greece*

When one speaks of art, his thought instinctively travels backward more than two thousand years to the classic examples of ancient Greece. Of furniture, however, practically nothing has survived the wreck of time. Unfortunately, no tombs preserve for us specimens of Greek handiwork. Greek mythology and worship did not require such reverence for the welfare of the dead. Nevertheless, the remains of sculptures and paintings, and reliefs in marble and terra cotta, as well as the famous painted vases,



some of which are preserved in the British Museum, indicate that furniture, combining both beauty and utility, was closely associated with Greek life. There are evidences, too, of the art of veneering. Homer indicates that the shield of Achilles was of plywood, for of it he says, "Five were the folds of the shield itself." The Greeks were also familiar with inlay. Ulysses, in describing in the *Odyssey* the bride-bed he had made, says, "Beginning from this head-post, I wrought at the bedstead till I had finished it, and made it fair with inlaid work of gold and of silver and of ivory." Numerous other references bear out these conclusions. And everywhere the spirit of Greek art was that of service to the nation. That was the theme which dominated the thought of those early masters and ran through their work like the harmony of a great musical composition.

Important as veneer work unquestionably was throughout all antiquity, it was in the life of imperial Rome that this form of art seems first to have come into flower. Although no examples of such furniture have come down to us, evidences abound as to its use. The literature of the time leaves no room for doubt. In Pliny's *Natural History*, written nearly two thousand years ago, we find the following:

"The citrus tree gave rise to a mania for fine tables, an extravagance with which the women reproach the men, when they complain of their vast outlay upon pearls. Notwithstanding his moderate means, Cicero gave no less than

one million sesterces (approximately \$20,000), for a veneered table of citrus wood."

Again, Pliny says, "The wood, too, of the beech is easily worked, although it is brittle and soft. Cut into thin layers of veneer, it is very flexible, but it is only used for the construction of boxes and desks. The wood, too, of the holm-oak is cut into veneers of remarkable thinness, the color of which is far from unsightly . . ."

Pollen, an authority in this field, says, "Veneering was universal in wood furniture. The slices of wood were laid down with glue as in modern work."

*The art of  
veneering  
flourishes  
in Rome*

Tables, richly embellished with veneers of choice woods, seemed to be the particular delight of the Roman nobleman. Pliny has told us that the most highly prized possession of Cæsar was a beautifully veneered table. Miss Caroline Ransom, in her *Studies in Ancient Furniture*, asserts that "Although not employed to such an extreme extent as for tables, costly woods, probably in the form of veneers, were not unusual in expensive couches. Couches which were veneered completely or nearly so with ivory were very popular." And while veneering in panels and door frames first came prominently into use among the Romans, yet it was on table tops that they lavished their money and their artistic skill. It is said that the effects produced by cross-cut veneers sometimes resembled the "stripes of the tiger," in others, the "tawny lion," "a swarm of



bees," or the "spots of the leopard." Beauty was the goal.

Lichfield, in speaking of Augustan furniture, says, "Veneers were cut and applied, not, as some have supposed, for the purpose of economy, but because by this means the most beautifully marked or figured specimens of the woods could be chosen, and a much richer and more decorative effect produced than would be possible when only solid timber was used."

And let us not forget that wherever the art of veneering flourished, so did that of making and applying glue. As useless as bricks without mortar, or sandstone without the natural cement that binds its grains together, would be thin pieces of costly woods in the absence of a dependable and enduring adhesive. Likewise, the beautiful inlays of ivory and precious stones and metals, for which the furniture of early times was famous.

Rome rose and fell. Then followed the black night of medieval darkness, lasting for approximately a thousand years and formally ending with the capture of Constantinople by the Turks in 1453. Changes of vast significance swept over Europe. This period saw the ascendancy of Charlemagne; the conquests of Britain by the Saxons, the Danes, and the Normans; the fortuitous rise of Mahomet; the subjection of Spain by the Moors; and the Crusades, uniting in a common purpose the military prowess of friend and foe.

*Art suffers an eclipse*

*The love of  
the beautiful  
disappears*

For centuries, art suffered an eclipse. All but forgotten were the skill of the master craftsman and the love of beautiful things. Only in the Byzantine Empire, centering about Constantinople, do we find some lingering traces of the arts of inlay and veneering. An outstanding example of the furniture of this period is the "Chair of St. Peter, richly veneered and inlaid with ivory and gold," now a priceless treasure of the Vatican in Rome. Although this period saw the rise of Gothic architecture, a noble product of the Crusades, the art of veneering did not flourish. In furniture, utility, not beauty, was the dominating motive. The only means of ornament was that of carving. Massiveness and rugged strength replaced the grace and beauty of earlier designs. Once more does the furniture of an epoch reflect its customs and its manners, its spirit and its very soul.

*The  
awakening*

Toward the close of this medieval nightmare of chaotic unrest came the dawn that precedes a new day. New life—exuberant, buoyant, abounding—coursed through every field of human endeavor. For a time wars ceased; peace reigned. Gladness and joy were on every hand. It was like the returning springtime, following the dormancy of winter's sleep. The accumulating, pent-up intellectual energy of preceding centuries burst its bonds. New ideas took root and spread with marvelous rapidity. Scientific discoveries and inventions came to the fore. Columbus discovered America; Gutenberg invented the printing press. Life, un-



fettered, gave full reign to the creative impulse. In Italy, the birth spot from which flowed this leavening influence, the nobles and men of wealth became patrons of the arts. Learning revived, producing a new interest in Greek and Roman antiquities. Out of such an atmosphere arose the genius of Leonardo da Vinci and in it Michælangelo, Raphael, Titian and Andrea del Sarto executed their masterpieces. In short, the Renaissance, a Golden Age of achievement, became the dominating influence in the civilization of Europe.

No more than a tree, sending its roots deep into fertile and well-watered soil, can escape the influence of the rising tide of life at returning springtime, could the art of furniture designing fail to respond to this re-birth of interest in things artistic and beautiful. The result was an elegance and luxury in home furnishings approaching those of the princes and noblemen of antiquity. Costly forms, elaborately designed and often extravagantly large, multiplied. Walnut, pear, maple, pine and cypress were among the favorite woods.

Intarsia, a form of veneer similar to inlay, became characteristic of the Renaissance period. For such decorative effects, agate, carnelian, mother-of-pearl, lapis lazuli, ivory and tortoise-shell were common. Later, particularly in the French designs of the eighteenth century, a modification of this type of veneering, known as marquetry, came into

*A new  
form of  
veneer  
work*



vogue. It comes from the French word, "marqueter," which means to spot, or mark. In effect, marquetry stands for pictures in wood. Seaweed and floral patterns abound in the French and English designs of the centuries immediately following the Renaissance.

*Veneering  
identifies  
itself with  
a personality*

Now, for the first time in the whole history of the furniture art, we are able to associate a particular piece of work with the personality of the master craftsman who wrought it. In Siena, we are told, was the "cradle of Italian carving and inlaying," and in Antonio Barili, one of the best artisans of that Renaissance center, we find a man whose work can be definitely identified with his name and skill. Intarsia work of his execution is to be seen in a panel of the choir of the Chapel of S. Giovanni. Marvelously simple were his tools and method—"a folding pocket-knife, a square-handled gouge, a short-bladed, long-handled knife," and the almost superhuman skill of the trained hand and eye. These, and an inborn sense of symmetry and beauty, wrought patterns which have commanded the admiration of all succeeding artists.

And again, whereas few pieces of actual furniture from earlier times have come down to us, the evidence for such creations, although authentic, being largely indirect, we now have preserved for us in the museums and art depositories of Paris, Rome, Venice and other European cities hundreds of priceless examples of Renaissance furniture,

many of them veneered. Let us note in passing, too, that a fundamental factor in the preservation of these treasures has been the enduring qualities of glue adhesives. Without them, many of these creations of the world's most exuberant period of artistic expression would today be "one with Nineveh and Tyre."

Not alone did art come to flower in Italy. The spirit of the Renaissance spread to every capital of Europe. French artists crossed the Alps to learn from Italian masters. Various forms of veneering became standard practise among the furniture craftsmen of every land. Inlays of exotic woods, ivory and metal, and of landscapes, flowers and birds, were the fashion of the time.

*The art of  
veneering  
spreads to  
other lands*

In England, it was in the reign of Queen Elizabeth that the re-birth of art and learning came into its own. This awakening was evidenced in a display of gaiety and color, in a love of brilliant pageantry, in the splendor of court ceremony and in an extravagance of manners and possessions. Shakespere was then writing his plays, and literature was enjoying a vigorous growth. True to traditional tendencies, the furniture of the time reflected this spirit of joyous life and spontaneity in a love of showiness and a display of ornamentation. Carving, inlay and veneer were means of expression. In this period of England's expanding trade and beginnings of empire, there arose a wealthy middle class, able to afford and keenly interested in advancing



the state of the domestic arts, chief among which was that of furniture making.

In Holland and Spain, too, the spirit of the new order was no less prominent. The artisans who served the wealthy burgomasters and the Spanish nobles became masters of marquetry and veneer. In the land of the Moors, tables and cabinets were inlaid with ivory, ebony, bronze and silver.

In no other field of art did the spirit of the Renaissance exert a more marked influence than in that of furniture designs. Its effects continued to be felt long after this period proper had passed into history. For a time, men had worked in a glad, new morning of human endeavor. Then, heartened and inspired, they moved forward with the advancing sun to fresh conquests.

*After the Renaissance*      The dawn, the rising sun and the dewy morning passed. Subdued somewhat, became the gladness of living, but the splendor of the Renaissance lingered. Nowhere else was this tendency so marked as in the seventy-two years' reign of Louis XIV of France, extending from 1643 to 1715. In furniture, the styles and tastes developed in that period of growth in things artistic have continued even to the present.

*A master artisan*      In André Charles Boule, we find a master artisan who has given his name to a particular kind of veneer work. Made head of the Royal Furniture Department and given







*A desk, rich with marquetry, of eighteenth century French design*

lodgings in the Palace of the Louvre, he devoted his life to this field of art. His particular creation was a method of laying down thin brass upon tortoise shell, or sometimes upon ivory or enameled metal, the whole being glued to a base, usually of oak. At first exceedingly costly, he at length developed a more economical method. Even to-day, Boule work is seen as a rich ornament of furniture decoration.

Probably the most historic piece of furniture coming down from the classic period of Louis XIV is the table, plywood built, upon which the Treaty of Versailles, ending the World War, was signed. The Palace of Versailles itself is a monument to the elegance and magnificence of that time of royal splendor.

In the reign of Louis XV, the form of veneering known as marquetry flourished under the direction of such masters as Crescent, Riesener and Roentgen. The furniture of the period reflected the pageantry of court life, rather than the wretchedness of the peasantry. Tastes were gay and elegant, and grace and beauty of detail were essential requirements of furniture design. The marquetry of Boule was displaced by veneers of rare woods. In the "Bureau of the King," said to be the most remarkable piece of furniture of the eighteenth century, and now preserved in the Palace of the Louvre, we have the rarest example of veneer work in the world. It is plywood construction throughout. Of it, an

*Marquetry  
flourishes  
in France*



editor of *The Guardian* in London has said, "It is remarkable alike for the boldness of its conception and the magnificent finish of its details—its lines are large, flowing, harmonious. It is the most famous and magnificent piece of furniture ever constructed."

A unique instance of a classic influence upon modern art is seen in the excavation of Herculaneum and Pompeii in the reign of Louis XVI. This event turned the attention of artists from the riotous extravagance prevailing in current French designs to those of ancient Rome. The result was a revival of classic styles. A remarkable survival of this period of the revolution is a sideboard, veneered throughout with mahogany, once the personal possession of Marie Antoinette and now in the Historical Museum of Portland, Maine.

Before me lies a picture of Napoleon's writing desk, carried everywhere on his campaigns. Plywood-built throughout and faced with rosewood veneer, it saw twenty years of the most severe military service, and it is said that there is not a chip to be seen. What could not this intimate piece of the great military leader's personal equipment tell, if it could but speak, of glory and intrigue, of victory and defeat, as it followed him from Austerlitz to Waterloo! At it he planned his campaigns, wrote his letters and prepared his proclamations. Designed for him by Sacci of Florence, it was built under his own direction and in accordance with his own plans.







*A writing desk, typical of the marquetry of the William and Mary period of English design*

In England, the art of veneering, begun in the reign of Queen Elizabeth, was continued, though to a less degree, under the Stuarts, and from sheer inertia during the unimaginative régime of Cromwell. Following the death, in 1659, of the great Commoner, walnut came into widespread use. About this time, too, the invention of a saw which could divide a board into as many thin sheets as were desired began to exert a profound influence on the use of veneers. In the Restoration, inlay and marquetry came to the fore once more, being extensively employed. It was then that the gate-leg table made its bow to the furniture world.

The Queen Anne Period, dominated by the simple domestic tastes of the joint sovereigns, William and Mary, made extensive use of walnut veneering. It was Queen Mary who introduced china closets, and such homelike pieces as tallboys, long-cased clocks, washstands, and mirrors for toilet tables. Impoverished by wars, the lack of resources made for a certain plainness and simplicity of furniture designs, as contrasted with the ostentation of the Elizabethan Age. Nevertheless, splendid workmanship was everywhere in evidence, and many noble examples of plywood and veneer have come down to us. One of the most noteworthy is the writing cabinet of Dean Swift, rich with walnut veneer and marquetry. At that desk he penned his *Letters to Stella* and wrote his immortal *Gulliver's Travels*. Another is the *Lost Treasure of Windsor*, a wonderfully



embellished bureau of classic veneer work, now restored and to be seen in Windsor Castle.

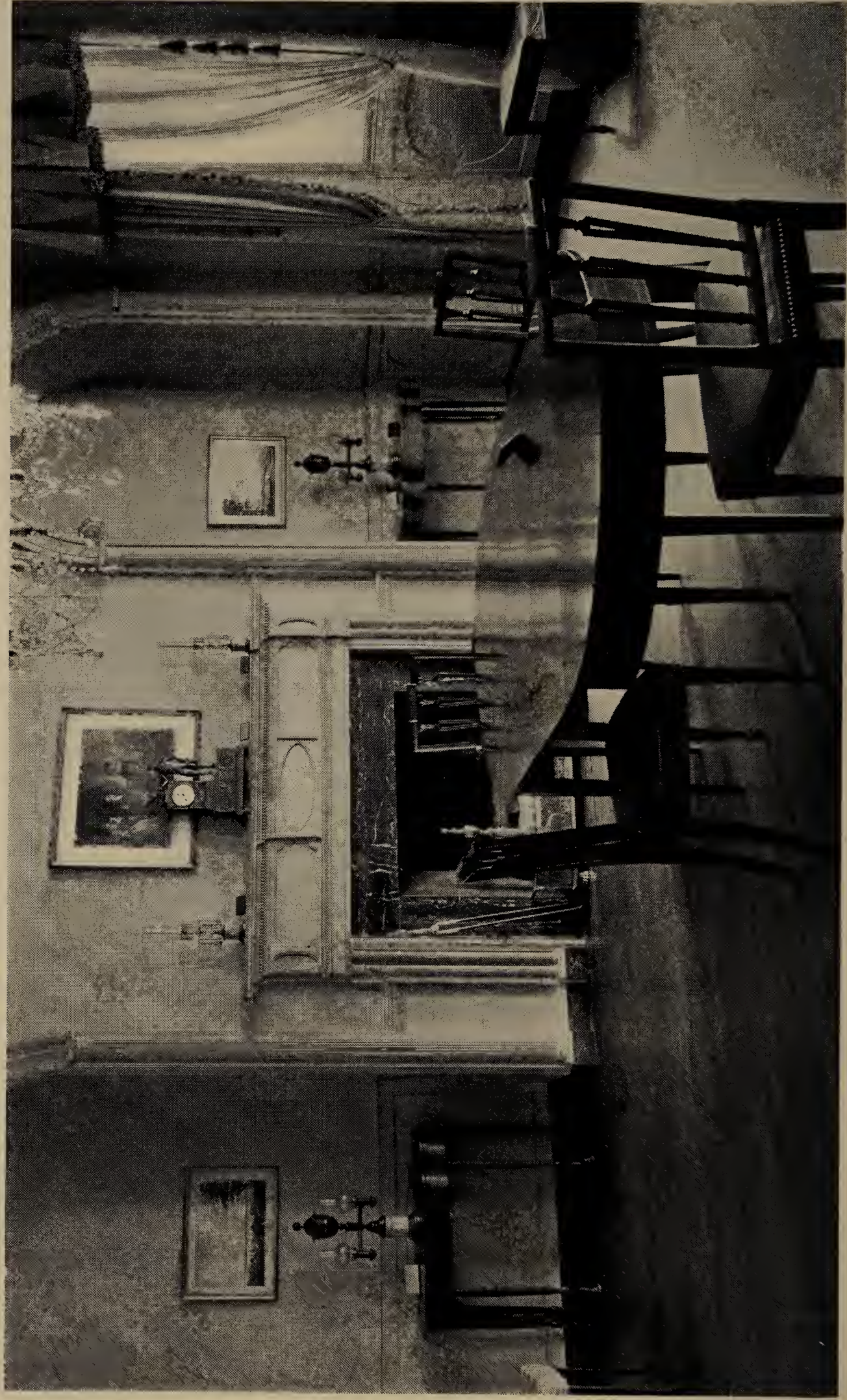
Not long ago, I spent some time in the Metropolitan Museum of Art. There, in numerous rooms, are to be seen examples of veneer work going back for centuries. In the Ninth Egyptian Room is a veneered coffin more than three thousand years old. Across those thirty centuries the artisan who wrought it, as it were, speaks to me from the workshops beside the Nile. As though it were yesterday, he seems to be working there, once again fashioning with infinite pains what is to be the eternal domicile of the remains of the daughter of the reigning Pharaoh. Reverently I leave the spot and, quickly stepping across the centuries, find myself in another age. Masterpieces of Italian, French and English art I pass in review. I try to visualize the settings in which these proud possessions once contributed to the intimate home life of wealthy merchant or titled prince. They speak, not of a dead but of a living past—a past throbbing with the vigor of youth, breathing of commerce and war, concealing the secrets of royalty, vibrant with the pulsating energy of human beings, who, only the other day, lived and fought and loved and died, even as we do now.

*A group  
of master  
designers*

In one of these rooms I come upon pieces of furniture fashioned from plans drawn by such master designers as Chippendale, Adam, Hepplewhite and Sheraton, names







*Drawing-room, typical of early nineteenth century American architecture; a reproduction by the Metropolitan Museum of Art from a house now standing in Delaware.*



which have become household words to the present day. I am in the Georgian period of furniture styles, spanning the interval of time from the early eighteenth century to the early nineteenth. Again, particularly in its latter half, this is a period in which the art of veneering holds sway. Mahogany and satinwood are the favorite woods. Adam, Hepplewhite and Sheraton were all devotees of the plywood principle, although Chippendale, a man of genius and a wonderful master of styles, employed more frequently solid woods in preference to veneers. 270727

Of this period is the "Sideboard of the Bank of England," veneered with satinwood and beautiful beyond description. It was designed by Shearer, another of the master artisans of the Georgian epoch. The celebrated bookcase of veneered mahogany, designed by Sheraton for *The London Times*, is another of the notable examples of this "golden age of furniture making." To accompany it, and built to match, are a veneered table, a small stand and a clock. Although over a century old, these classics are as fresh and beautiful as when first fashioned. This defiance of the ravages of time, too, must in no small degree be credited to the enduring qualities of veneer construction, made possible by the use of glue.

In the American Wing of the Metropolitan Museum of Art, one veritably finds himself in the atmosphere of Colonial America. Whole rooms, precisely as they originally

*The art of  
veneering  
comes to  
America*

were, even to the floor-boards, woodwork and wall-paper, have been transplanted for the benefit of the modern lover of antiques. With scarcely a stretch of the imagination, one finds himself sitting in the genial glow of a fireplace in a New England mansion of Colonial days. Forgotten are the hurrying throngs and the crush of automobiles in the busy thoroughfare outside. The skyscrapers of this most modern city vanish. Its far-flung area dwindles to the modest proportions of an overgrown rural village. The marvelous inventions of a century and a half of unparalleled material progress cease to impress us. In imagination we see the stage coach and the post rider once more, the ox cart and the sailboat. In this near-antiquity of our great-grandfathers' time, tallow candles provide our light, as the shadows of the hard-wood fire softly come and go on woodwork and articles of furniture, which are to become priceless treasures of succeeding generations. Real people come to life, garbed in the quaint dress of pre-revolutionary days. Somehow, the feeling of out-of-dateness slips away. A naturalness, wholesome and simple, takes possession of our souls. We have unrolled the scroll of time a little way and find it pleasant to be amid the scenes of yesteryears. Their fascination grips our minds. The spirit of Colonial America has cast its spell upon us. And all because, for the moment, we are surrounded with the architecture and domestic furnishings of a by-gone day. And what simplicity we find! As contrasted with the ugliness of later designs,







*Highboy and lowboy of Colonial design; veneered walnut, inlaid, carved and gilded*

the atmosphere is as fresh as the breath of mountain air.

Trailing a decade or so behind the patterns set by the artisans of the home countries, Colonial furniture imitated these styles. Gradually, rich veneers of the finest workmanship began to supplant the solid pieces of the early times. As the pioneers subdued the wilderness and overseas commerce brought wealth to the merchants of the seaboard towns, the love of beautiful furnishings grew. The American Windsor chair, in a variety of graceful forms, became characteristic of the period. It was in a Windsor chair that Thomas Jefferson sat when he penned the Declaration of Independence. Martha Washington used them at Mount Vernon, the Mecca of Colonial art. There one will see, too, a Hepplewhite sideboard of mahogany crotch veneer, a treasured harpsichord, veneered with mahogany and inlaid with satinwood, a plywood bookcase presented to Washington by his mother, a chest of mahogany veneer, the personal possession of Martha Washington, and many similar pieces. In the late Colonial furniture, veneers of highly figured and finely grained woods dominated the field.

*Historic  
pieces of  
Colonial  
furniture*

Three historic desks, notable for their plywood and veneer, are now priceless relics of the nation. They are the desks of William Penn and Daniel Webster, and the desk at which Thomas Jefferson wrote the Declaration of Independence.



*An  
American  
master*

In Duncan Phyfe, a Scotch cabinet-maker of New York, America claims a designer of the late Colonial period whose best work rivals that of his Georgian contemporaries. In particular, he was a master of the fine art of veneering.

In America, after the first quarter of the nineteenth century, as also in the Victorian period of England, the art of furniture designing suffered eclipse. The new forms which came into vogue are variously described as "runaway styles," "horrors" and "atrocities." The Great Exhibition in London in 1851 and the Centennial in America gave striking confirmation of these charges. An abundance of cheap lumber and the advent of machinery seem to have been large factors in the debacle. That the classic tastes of the eighteenth century should have so quickly deteriorated is a unique feature of the history of furniture designing.

Once more, however, the sun is shining. In this first generation of the twentieth century, the pendulum is swinging in the opposite direction. The riot of inartistic production is ending; in fact, has ended. The quiet simplicity and elegance of happier times are dominating the tastes displayed in home furnishings. The higher standards of art are again asserting themselves. Thus it seems that decadence in this field can never be more than temporary. Now, as ever, progress is the watchword of the future.



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## CHAPTER III

### *A Glance at the Past*

GLUE, too, plays one of the principal parts in all veneering and works of marquetry." Thus wrote Pliny, the Roman naturalist, nearly two thousand years ago. The practical truth of the statement, even then, was centuries old. The practise of gluing as developed by primitive men before the dawn of history remained the practise down to the present century. For more than three thousand years the art did not change. It was only yesterday that a pioneer in this ancient field discovered a new and better way. The ways of the fathers had seemed to be good enough for artisans of all former times. The conservatism of more than thirty centuries had erected an apparently insurmountable barrier to further progress. Men did not like to be jostled from their comfortable niches of seeming security. It has always been so. It probably always will be so. "Let well enough alone" is a bit of worldly "wisdom" that has stood in the way of many a project for human betterment.

Hats off, too, to the tried and proved methods whereby society has made its practical advances. No one wishes to belittle them. They loom large on the horizon of past achievements. Their significance is immense. Still, be it

sooner or be it later, one descries along practically every avenue of human endeavor distinct advances—along some, many; along others, few. An upward trend seems to be the order of progress. As the late Newell Dwight Hillis has said, “Slowly the fire mist cools, puts on a decent crust, and becomes the home of cities and civilizations. Slowly the soil climbs toward grass and shrub and flower. Slowly the little rose, always single and pink, drops its petals to enrich the soil, that tomorrow’s rose may be double and crimson with every hue and perfume. Slowly the thorn apple becomes the Winesap and the Golden Pippin. Slowly the wild rice becomes the Fife wheat; the Indian corn that had six husks around every grain climbs toward the ear that has husks only on the outside of all the grains. Slowly the hut becomes the home; the forked stick a steam plow; the hollow log, the *Mauretania*; the rude hieroglyphs upon the tree, telling which way the hunter went, become letters and literature. Slowly the ochre on the cheek of the savage becomes the canvas on the wall; and the stone altar becomes the cathedral, while the medicine man, pounding on the drum, becomes the pipe organ. . . .”

Thus, “the old order changeth, giving place to new,” though it be ever so “slowly.”

Turning points  
in man's  
progress

The sailboat and the stage coach were good enough until the coming of the steamboat and the locomotive. The tallow candle lighted the world until kerosene, gas and



electricity displaced it. Beacon lights, flashed from hill to hill, or swift messengers, sufficed for communication until Morse, Bell and Marconi annihilated space and banished isolation. Horses reigned supreme on country highway and city thoroughfare until the coming of the automobile has made them almost as extinct as a dinosaur. Men beheld the majesty of the stars with the naked eye until Galileo swept the heavens with his telescope and brought other worlds, innumerable, to view. Parchment scrolls preserved the learning of the past until Gutenberg invented the printing press. Men set type by hand until the linotype machine showed a better way. The ironsmith smelted ore in driblets until the blast furnace and the converter revolutionized the industry. The farmer cut his grain with a sickle and threshed it with a flail until the reaper and the threshing machine brought his emancipation.

And so one might continue. The art of making and applying glue, too, affords no exception to the rule. It offers the same old story, save that the revolution was longer in coming. But come it did, and that within the memories of the present generation. The emancipation that it wrought, too, is scarcely less significant than many another in the history of human progress. That we may the better understand it, let us take a bird's-eye view of the prior art.

Just when or under what circumstances primitive men discovered that the cooking of certain animal refuse, such

*Discoveries  
of early men*



as the hides or bones of cattle, the fleshings, sinews, cartilage, horn piths and other animal parts would provide, when allowed to jelly, a sticky, gluey mass, we can only imagine. Certain it is that it came long after the mastery of fire and when man had progressed sufficiently in the domestic arts to cook his food. Like so many other discoveries, it doubtless came by accident. When first observed, there could have been no possible use for the sticky stuff. More than likely it was regarded as an unmitigated nuisance. But the memory lingered. Over and over, and in numerous places, the experience was encountered. The circumstance simply could not be forgotten. Some day, probably centuries beyond the time of discovery, it was to find its niche of usefulness. Probably no bit of knowledge was ever acquired in vain.

When that time arrived it is useless to conjecture, but arrive it did. In all probability the adhesive properties of the material in holding together two pieces of wood were stumbled upon, not deliberately sought. And let us not imagine that when some primitive craftsman did try to duplicate the process his efforts met with immediate success. If those early experimenters encountered a tenth part of the difficulties experienced within the present generation of modern enlightenment by the discoverer of Vegetable Glue, they were sufficient. Yet, if the truth were known, their troubles were without doubt many times as numerous and exasperating. But there was a difference. Time meant

nothing then. Those men could afford to be leisurely. They had no dividends or payrolls to meet, no interest to pay, no particular vision of a new and better order of things as a result of their experiments. Nevertheless, all the world may be grateful that they did experiment. They were the pioneers, and the progress of the world always moves along the trails which they blaze.

Bit by bit knowledge grew. Horizons widened. Each generation stood on the shoulders of its predecessors. It was the heir of all that had gone before. Someway, as the need of an advancing civilization became more urgent, those early inquirers into the secrets of Mother Nature discovered that this stuff which we call animal glue, and which they may not have called by any name, must be thoroughly soaked in water before use, melted at a relatively high temperature, applied in a hot, humid room, and the glued pieces subjected to immediate pressure, being weighted down by heated stone cauls, held in place by bags of sand during the process of setting. I submit to the reader that all this was quite some knowledge for primitive gropers in the dark to have acquired before the dawn of history. I take off my hat to those men of long ago. They were men of no mean stature.

The tragedy of it all is, however, that we have made little advance over those primitive methods in the use of animal glue, even to the present day. The general procedure is much the same. The initial objections to this form of



glue have not been entirely overcome, as we shall see.

*Thirty  
centuries of  
stagnation  
in the use  
of glue*

What should we think today, were we compelled to practise agriculture by the methods employed in ancient Egypt? And yet, until only the other day, as time goes, that is what the craftsmen in the art of veneering had to do in their use of glue. It seems incredible, but it is true. Their emancipation was long delayed, and when it came there were many who resisted it. However, these objectors were simply repeating the experience of all history. They were running true to form. Just as the textile workers of England, a century and a half ago, smashed the spinning-jennies and the looms, because they believed these inventions would deprive them of employment, so did the inborn conservatism of many manufacturers and workers oppose the coming of Vegetable Glue. They could not see that this invention foreshadowed a new day in the veneering industry; that it promised the first revolution in the use of glue since the beginning of the art. But of this, more later.

*Other  
glues*

As has been indicated in another place, the Egyptians were probably also familiar with fish glue and casein glue. The former is a liquid glue, made from the heads, bones, skins, trimmings and swimming bladders of fish. Its properties are similar to those of animal glues, but although the best glues of this type often make strong wood joints, fish glue has never figured largely in veneer work. Its



chief field is that of patchwork and small gluing projects.

Casein is a product of the curd of milk. In fresh milk it is held in a condition of semi-solution, in what is known as the colloidal state. It may be coagulated by simple souring, or by the addition of dilute mineral acids. For glue, the crude casein is purified by washing, dried and then ground to a fine powder. In preparing this glue, the casein is mixed with water and certain chemicals. Aside from its relatively small use in glue, casein is finding application in the field of plastics. A multitude of products from billiard balls to knife handles and buttons, rivaling those made from bakelite and celluloid, are on the market.

Another adhesive, not much used here, but employed to a limited extent in European and Asiatic countries, is blood albumin glue. This glue is used in making highly water-resistant plywood.

Still another substance employed for gluing purposes is sodium silicate, long familiar as waterglass, used for the preservation of eggs. However, this is never applied to furniture, for the slow action of the air causes joints made with it to break down after a few months.

Now, with the historic background of the veneering and gluing arts sketched from early times to the beginning of the twentieth century, we can turn to *The Story of Vegetable Glue*. As we follow it, we shall discover that the record of progress written since 1900 may truly be designated as little short of revolutionary.

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## CHAPTER IV

### *Looking Forward*

PHILOSOPHY teaches us that personality is the keynote of the universe. But, be that as it may, certain it is that no important project in the affairs of men ever came to fruition without being associated with some great life. It is true everywhere—in literature, art, science, invention. Every big achievement is the product of a master mind. Examples might be multiplied. History is full of them. Indeed, without this overshadowing factor there would be no written history.

*The story of  
a dreamer  
and a builder*

Accordingly, in telling The Story of Vegetable Glue we must begin with the man whose vision and indefatigable industry made the achievement possible. His name was Frank Gardner Perkins, a man who did not know when he was beaten, a circumstance for which we may all be grateful. I venture to say that few of you have ever before heard this name, but like many another soldier in the ranks, his contribution is none the less important because he is unknown to fame. I have entitled this chapter "Looking Forward," for if there is one quality more than another that governed the actions of Mr. Perkins, it was this ability to



look into the future, to catch a far-reaching glimpse of a new and better day. In short, he was a dreamer, but he was more. He was a leader. He not only caught the vision; he could take the initiative in helping his fellows to translate it from the realm of dreams into that of tangible reality. And though he worked with prosaic materials, he was a builder none the less.

We see Perkins first as a school boy in Lowell, Massachusetts, where he was born, December 4, 1866. Coming from a long line of New England forebears, who at one time or another had inhabited practically every State of that early stronghold of native Americanism, upon graduating from high school he looked forward to a life in the naval service of his country. However, although he successfully passed the examinations for Annapolis, on account of defective eyesight he was not accepted for entrance. Thus, being barred from the pursuit of his choice, he turned to mechanical engineering and entered the field of heating and ventilating.

Perkins' inventive bent was first displayed in the solution of a problem for the old Chicago Sugar Refining Company. It was a matter of dehydration, and in this work he devised and patented a dryer for the purpose. Little did Perkins then realize that this invention was to carry him far afield. Yet it proved to be the entering wedge which opened the door to a great adventure. In that adventure

*Mr. Perkins  
begins an  
adventure*



we are now interested. Let us follow along the trail

If carbohydrates had to be dehydrated, there must be material of this sort to dehydrate. Someone must produce it. Why should not Perkins share in the industry? Accordingly, in 1898, he moved to Wisconsin and with a friend started a factory. Thus, without knowing it, the adventure was on. However, like many another, it began in failure. Indeed, during the greater part of this man's all too short life, his plans were frequently thwarted. Success always seemed to be just around the corner. Time and again, apparent defeat stared him in the face. Yet the seed he sowed was to yield a bountiful harvest. But we must tell the story.

The venture in Wisconsin proved to be a disappointment. It promised no future. The factory, started with such high hope, was abandoned and Perkins found himself seeking another field to enter. And it was at hand—ready and waiting for him. In far-away Florida an infant industry was looming on the horizon. Some one down there had captured a brilliant idea. It was proposed to raise the cassava root, a tropical plant whose pedigree I shall give you later, for the purpose of manufacturing cassava flour. Little cassava flour had ever before been produced in the United States, or in North America for that matter. Nevertheless, that did not mean that the thing could not be done. At least not to a man of Perkins' temperament. Immediately he investigated the proposition and decided that it was sound. Some cassava had been grown in Florida and consumed locally







*Laying up cassava stocks for future planting*



as food. If so, why not grow it for industry? He would try.

The die had been cast. There was no turning back. The decision was no sooner made than Perkins was on the march. That was his way. He was a man of quick judgments and large enthusiasms. His was essentially the spirit of the pioneer. He was a typical pathfinder, a trail-blazer. March, 1899, found him in Jamaica, West Indies, arranging to import seed cane for the Florida planting. That was the essential first step, for cassava could not be expected to grow without a plentiful supply of good seed, and Florida provided none. *A decision is made*

But this was only a first step. An organization must be perfected to handle the business. Farmers must be induced to grow the new crop. Skepticism must be overcome. A factory would be needed. Freight rates for the manufactured product would have to be adjusted. Markets would need to be developed. The users would have to be convinced that cassava flour produced in Florida was as good for their purposes as that imported from the East Indies. Even then a multitude of details were clamoring for attention. Still the magnitude of the undertaking in no way daunted Perkins. He entered upon it with all the enthusiasm of young manhood and the vigor bequeathed to him by his New England ancestry. If there were obstacles, they must be surmounted. That was all.

*The  
Planters'  
Manufactur-  
ing Company  
is organized*

In August of this same year, 1899, Perkins organized the Planters' Manufacturing Company, which he incorporated in Maine. The stockholders were members of his own family and a few personal friends, who had caught the contagion of the young engineer's enthusiasm. For if ever a man believed in an enterprise, Perkins believed in this. And he was right, absolutely right. There was just one weak spot in the foundation upon which he erected his air-castle. Presently we shall see what it was.

With a masterly insight into the task that lay ahead of him, Perkins began a campaign of education. Agriculture in Florida at that time was in a pioneer stage. Lumbering, naval stores and citrus culture were the main industries. Believing that big money lay in the citrus groves, many were inclined to look with scorn upon a staple but less remunerative crop, such as cassava promised to afford. Perkins proceeded to show these folks that more money with less labor could be made by engaging in his agricultural enterprise than could be made in raising citrus fruits.

The elements themselves, too, had seemed to make the year 1899 an auspicious moment for the inauguration of the project. In February the "big freeze" occurred, a calamity which is not forgotten to this day. Rich and poor were hit. No one was spared. Desolation stalked in the midst of the land. The small citrus growers were wiped out. Eagerly they turned to Perkins as the savior of the situation. No longer did they despise the industry which







*Mr. Perkins in a cassava patch during the Florida experiment*



he offered to the State. Overnight, it took a leading place.

The Planters' Manufacturing Company, like a friend in time of need, advanced money to the Florida farmers for fertilizer and labor, and in some cases even for food. Then, at the end of the season, the Company purchased the crop which the farmers grew. In addition it acquired 2,000 acres of land and itself entered upon the large-scale cultivation of cassava.

With an energy that was boundless and untiring, Perkins taught those farmers how to plant the seed, how to fertilize and till the soil, and how to harvest the crop. He tried to make the citrus growers share his own conviction that cassava might be profitably grown in their groves, with distinct advantage to their major crop. He pointed out the multitudinous uses to which cassava flour might be put, the immense market that only awaited development. And he proceeded to develop this commercial field in a large way.

*Mr. Perkins  
seeks to  
establish an  
industry*

At Lake Mary, close to an inexhaustible supply of pure water and served by good railroad facilities, Perkins built a factory for the manufacture of cassava flour. Furthermore, he shipped his product to northern consumers, where it received flattering endorsements from a large number of satisfied customers. For about four years Perkins continued to carry on. He believed in himself, in the future of the industry and in the State of his adoption. Then came the great disillusionment.

Here is the only factor which Perkins did not sufficiently take into account. Cassava is a tropical plant; in fact, as it proved, entirely so. It had been confidently believed that it would thrive in the semi-tropical climate of Florida. That it refused to do, and thereby hangs the sad sequel of the Planters' Manufacturing Company. Gradually the grim reality of fate forced Perkins and his associates to the tragic conclusion that their entire investment, amounting to almost \$300,000, had been sunk in the enterprise. There was nothing to do but pocket the loss and begin anew. But where and how? What again could offer a more promising future than had the cultivation of the cassava plant in Florida? It took courage of a rare quality to face that situation. But courage of just that kind was a chief ingredient of Perkins' make-up.

Fortunately, there is never a cloud so black that it does not have its silver lining. And so it proved in this case. In the succeeding chapter we shall see how it came to view.



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## CHAPTER V

### *Another Turn of the Wheel of Fortune*

THE story of invention is to a surprisingly large degree a record of happy accidents. However, as the great French scientist Lagrange said of Sir Isaac Newton, "Such accidents only meet persons who deserve them." The crowning achievement of Frank Gardner Perkins' life was no exception to this rule.

There was nothing dramatic, however, about the accident in Perkins' case. It offers no opportunity for the brush of the artist. To a less keen observer it would have passed unnoticed. Doubtless it had escaped the attention of many another, time and again. Not so with Perkins. He made bold to challenge this fact of Nature, and thereby opened the door to a new day in the art of veneering.

Strikingly enough this accident must parallel very *A* closely many similar discoveries by primitive men. In this, *discovery* Perkins more than likely followed the traditional route. It came about in those heroic days when he was immersed in the cassava industry in Florida. Occasionally he noticed that when a batch of cassava flour had been carried too far in the processing, a product having the qualities of good

glue came from the kettle. Not once but many times this circumstance smote him in the face. It did more; it set Perkins to thinking. And there is nothing more powerful in this world than a thought moving along the right channel.

Perkins began to experiment. That was a peculiarity of this man. He knew that the only way to discover the merits of an idea is to try it out. There is little older in the history of industry than the art of gluing. There was no mystery regarding the proper method to pursue. Perkins did not delay. He tried the stuff with wood, and to his great satisfaction found that it made an excellent joint. In that moment Vegetable Glue became a potential factor in the furniture industry of this and other countries. Mind you, I say "potential," for there was a long road yet to travel before this discovery was to become a dominating influence in the art of gluing.

*A* To Perkins here seemed an opportunity to retrieve the *vision* Florida disaster and at the same time to perform a service of immense significance for his fellowmen. If cassava flour could not be produced successfully in this country, it could be imported. Furthermore, there was no doubt in Perkins' mind that it afforded a thoroughly practicable base for the manufacture of a new type of glue. Of course, funds were necessary for the new venture. It would seem that a man who had just succeeded in losing almost \$300,000 of his



own and others' money in one ill-fated undertaking might have difficulty in this. But Perkins radiated enthusiasm and inspired confidence to an extraordinary degree. Men could not help but believe in him. They knew him to be honest and sincere and of the highest integrity. Gladly did certain good and trusting friends follow his leadership and back him again with their money. In fact he was fortunate in having two aunts who, during this critical period, gave evidence of their trust in him by supplying a large part of his working funds.

We are now down to the year 1905 in the story of Mr. Perkins' fortunes, the year that saw the final abandonment of the original Florida project and the beginning of Vegetable Glue. In fact, that is why this book is being written, to commemorate the twenty-fifth anniversary of this discovery.

Convinced of the meritorious character of his new product, Perkins sought to find a market and at the same time to test its qualities under the severe conditions of actual usage. In the Brooklyn Cooperage Company, at Poplar Bluff, Missouri, he found a concern that was willing to be shown. However, Perkins was eager to show anyone, whether he hailed from Missouri or anywhere else.

As Perkins soon discovered, the new road upon which *A* he had entered was far from smooth. The going was hard *practical* and the progress slow. It was one thing to make satisfac-*test*

tory preliminary tests; quite another to meet the exacting requirements of industry. And so the Poplar Bluff experience proved. However, we must emphasize that at this time Perkins regarded his product as only in the experimental state. Events proved this to be very much the case. Manifolds were his troubles. He did not then know the exact proportion of water required, nor the tackiness and life of the product. The caustic soda, too, which he used in making the glue, attacked the hands of the workmen. He forthwith provided gloves for the men and continued to experiment with the mixture. It was impossible to tell whether a particular batch of glue would be satisfactory until the glued-up heads were taken from the presses. Then it might be discovered that a carload of stock had been spoiled. Time and again Perkins was called to Poplar Bluff to remedy difficulties. However, he was simply traveling the well-trod path of many another inventor. Baffling as the process seemed, he had no doubt as to ultimate success. And he was right.

Two other commercial trials were no more successful. They were in veneer factories, one in the North, the other in the South, and each proved to be a costly failure. A man of less determination would have given up.

*A turn  
in the  
road*

Not far from Poplar Bluff, at Cairo, Illinois, was the location of one of the cabinet factories of the Singer Manufacturing Company. This vast organization used glue in



large quantities. Why not get it to give his product a trial, thought Perkins. And with this man, to think was to act. Immediately he went to the management of that company and told them of his invention. They were interested. Contrary to characteristic cases of the kind, these people could see the great value and immense superiority of the Perkins product, if it would stand the practical tests. There was only one way to know: try it out.

And what a trial they contrived! They glued up a number of cabinet panels and placed them in every disadvantageous place imaginable—on the tops of the boilers, behind steam radiators, in the basement, in rooms subject to marked changes of temperature, and elsewhere. Then they waited a year to see what would happen. What would the quality of these joints be after many months of seasonable and unseasonable changes, changes more severe than any to which furniture is ever likely to be subjected?

But to be compelled to wait a year, on a not entirely certain outcome, was a severe sentence. Perkins' funds were gone. He had no other source of income. He and his family must live. He was in much the same straits as Robert Goodyear, when a century ago he was trailing the secret of the vulcanization of rubber to its lair. It took courage to face that year. Without unfailing confidence in the permanent qualities of his product, it could not have been done. But on that score Perkins had no doubts. At least he felt certain that if his glue were not then entirely right in

every particular, he could make it so. Buoyed up by this inner faith and assisted by loyal friends, he weathered the year. It could not last forever.

*Vegetable  
Glue wins  
a triumph* And with its end came the turn in the road. The glue had stood the tests. The joints were good. The Singer Company was satisfied and expressed a willingness to install the use of the glue in its factory at South Bend, Indiana. You can well imagine the rejoicing on the part of Perkins and his associates. Success now seemed at hand. Still, there was a long way yet to go.

*The origin of  
Perkins 183"* In September, 1906, Perkins began operations in the Singer plant at South Bend. The task that confronted him was an exacting one. He must now glue cabinet work for the trade. This might be shipped anywhere—North, South, East, West, or overseas. It must satisfy the buying public. And this was fine material with which he was to work, a vastly different proposition from that of the barrel-head factory.

Perkins began with the glue which he at the time believed best suited to the work in hand. He called this No. 1. But he continued to experiment and test and to compare results. Perkins was a born experimenter, and nothing but the best would satisfy him. Pretty soon he had a whole series of glues, which he numbered consecutively. Tentative glues, one might call them. The goal was a standard







*The old Florida factory of the Planters' Company*



glue which could be manufactured in quantity and applied by anyone, anywhere, under any conditions in accordance with routine instructions. Perkins knew that a successful glue business could be built on nothing short of such a broad foundation of scientific certainty. Therein he showed the calibre of man he was. He was more than pioneer. He was a builder.

Now we must get another angle to the situation. Although the Florida project had been abandoned, the factory at Lake Mary had been retained, and it was there that the glue was being manufactured. This work was under the direction of Mr. J. B. B. Stryker, brother-in-law and associate of Mr. Perkins, and now President of the Company. As Perkins proceeded with his experiments, all the while making important discoveries, he telegraphed instructions to Stryker. It was a tedious process. Often Stryker was discouraged, and at one point he was almost ready to quit. Still, with dogged determination, they persisted. Progress was being made. Each month brought the objective nearer. Finally, in July 1907, Stryker received the gratifying message that in No. 183 a satisfactory commercial glue had been obtained, a glue that would no longer require Perkins' supervision in the South Bend factory.

*A standardized product is created*

The turn in the road had been reached and passed. A standardized product had been created. The next step was to introduce it to the trade. Problems never ceased. One

was no sooner solved than another presented itself. But Perkins' resourcefulness always came to the fore. He now knew that he had a proved and thoroughly reliable article. The experimental stage was behind him. The introduction of Vegetable Glue would be but a mere matter of more work, and work—that was the thing he thrived on.

You now see the origin of "Perkins 183." Its significance is clear. It was the product of 183 distinct lines of investigation; research, we call it now. Incidentally, it throws some light upon the painstaking care with which this product was developed. It reminds one of Paul Erlich's classic search for a specific and his crowning triumph in the discovery of "606." More significant still is the fact that "Perkins 183" has remained, from that day to this, the standard of comparison for all vegetable wood glue. The Company has at times made some other glues for special purposes, but the triumph of the Summer of 1907 has since been and is today the glue par excellence.



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## CHAPTER VI

### *More Difficulties*

**D**IFFICULTIES? Yes; the highway that Perkins chose to travel seemed to be forever paved with them. The struggle for a high-grade product had been completed. The battle had been won. But in some respects a more stubborn and trying one lay ahead. Perkins must convince the public of the desirability of his invention, for invention this truly was. An invention does not need to be fashioned of bronze or steel. A distinctly new and better way of doing anything is an invention. And Perkins had made an invention worthy of the long years of effort given to it.

Before plunging into this sea of fresh difficulties, however, let us get a picture of the infant organization, as it was shaping itself for the furniture manufacturing trade.

As we have seen, the factory for the manufacture of the glue was in Florida, while Mr. Perkins' initial success came in South Bend, Indiana. Quite naturally all the correspondence regarding the introduction of the new product was carried on from South Bend, where a temporary office had been opened. Thus a dual relationship between factory and sales office arose, which has continued to the present.

However, the factory did not long remain in Florida.

Cassava flour was the indispensable raw material for the manufacture of Perkins Glue. All the early experiments were carried out with the Florida product, which continued to be grown on a small scale. However, the impracticability of continuing cassava culture in that State, or in any other State for that matter, had been amply demonstrated. The cost to prove this, we remember, had been almost \$300,000, surely a sum sufficiently large to give any future ill-informed enthusiast serious pause.

*The center  
of an  
infant  
industry  
moves North*

Now began the first of the difficulties. When Vegetable Glue came to be shipped in carload lots, as it soon was, the supply of Florida cassava flour proved to be inadequate. It then became necessary to import it, landing it at the port of New York and reshipping to the factory in Florida. Then the manufactured output had to be sent North, where the markets were. This was costly business. Freight charges were enormous. Still, there was a relatively simple way out of the difficulty. The factory could be moved North, and this was done. In 1909 a site was found at Lansdale, Pennsylvania, on the Reading Railroad, twenty-five miles from Philadelphia. Forthwith a factory was built and there the manufacturing center has since remained.

It is an interesting circumstance that the funds for the erection of this plant were supplied by one of the large users of the new glue, the company receiving a return of





*A glimpse of the Company's cassava culture in Java*





its money by deducting a cent a pound on the glue it purchased, until the debt was absorbed. It is also gratifying to know that this friend in need is today a valued customer of the Perkins Glue Company.

The two years separating the success of the Summer of 1907 and the location of the plant at Lansdale were strenuous ones. At the very start of the sales business, Perkins was confronted with a difficulty of the first magnitude. The old animal glue cookers and spreaders were not adapted to Vegetable Glue. This seemed tragedy, almost a Waterloo. Who was going to bother with a product that could not be used in the time-honored way, especially when the newcomer was regarded as of doubtful value anyway? There was just one thing to be done: develop suitable machinery for use with Perkins Glue. Otherwise the situation was lost.

Baffled a bit, of course, but a long way from being defeated, once more Perkins began to experiment. It was no small problem that confronted him. He was in much the position of Sir William Perkin, when in 1856, as a lad of seventeen, he had discovered the first coal tar dye and had persuaded his father to build him a factory for its manufacture. No machinery adapted to young Perkin's purpose was then made. He had to design it and have it built. So did Perkins, and it cost money, a great deal.

*Vegetable  
Glue  
faces  
a crisis*

Perkins perfected the machinery and undertook its

manufacture in his own plant. He had turned another corner. Light shone through the darkness, but he was far from being out of the woods. Another difficulty must be met. It was one thing to invent specialized machinery, exacting as that was, and quite another to convince a manufacturer of the desirability of investing a considerable sum in this machinery in order to be able to use the new glue. Centuries of intrenched conservatism stood in Perkins' way. Not only must he overcome the inborn prejudice of human nature against the adoption of new ideas; he must meet the formidable opposition of the animal glue industry. Powerful forces were arrayed against him. But the problem was narrowing. Its solution was bound to come.

*Solving  
a difficult  
problem*

A unique plan solved the machinery problem. The Company went to the prospective customer with the proposal to install the machines in his factory, instruct him in their use, and then, if his consumption of glue were large enough to warrant, not charge him anything for this service. In the case of small users, a moderate rental was charged. Often the Perkins Company was required to make a very substantial investment in a customer's plant before it received a dollar in return. No fairer proposition was ever made to the public, and the trade responded, because it was found to be decidedly to its advantage to do so. Such a plan could not do anything else but inspire confidence. When an organization is willing to back its product with its money



in such sums, suspicion takes wings. Never did "money talk" more eloquently than here. It was an argument under which the strongest opposition weakened.

Thus another of the difficulties vanished. An important factor in bringing about this success was the "blanket guarantee" to save the customer at least twenty per cent on his annual glue cost. As a matter of fact, this saving frequently amounted to more than fifty per cent. Important, however, as this saving was, there was another circumstance, not possible to reckon in dollars and cents, which was of even more significance. This was the improved working conditions for factory employees made possible by the coming of Vegetable Glue. To this and other outstanding advantages of the Perkins discovery, I now invite your attention.

Prior to the discovery of Frank Gardner Perkins in 1905, as we shall show at the proper place, not a pound of Vegetable Glue had ever been used in any workshop in the world. So far as the art of gluing was concerned, the wood-working trades for all practical purposes had not advanced beyond the banks of the Nile. Of course, much progress had been made in the perfection of machines and methods of application, but the character of the glue itself was essentially the same as in the days of the Pharaohs. That was the situation that confronted Perkins when he began to build a new industry upon the ruins of an old one.

*A new day  
in the wood-  
working  
trades*

Let us see what this new day has meant to the trades in question and to the nation itself.

*Perkins Glue  
saves millions*

Returning to the purely mercenary side of this venture, we shall observe first that, starting from nothing in 1905, the amount of Perkins Glue sold has steadily mounted with the years until at the beginning of 1930 the total had reached something more than 230,000,000 pounds. To say that the use of this glue has meant an average saving of eleven to thirteen cents a pound is a conservative estimate. A simple calculation shows that this has given a saving on first cost alone of approximately \$27,000,000, no small item. If we were to take into account the increased spread of Vegetable Glue, the improved methods of application possible with its use and the service rendered to its customers by the company, this figure would be substantially increased. So much for one of the economic aspects of the new day.

More important still is the service rendered by Vegetable Glue during the World War. Though it won no medals and was never decorated, it was a willing soldier in the ranks. The simple fact is that animal glue would have been wholly inadequate to meet the situation in the hour of dire need. There was not enough, and the price would have been prohibitive. Without Vegetable Glue, industries of strategic importance would have been compelled to close. More: in these days of peace, it is a well recognized fact



that there is not sufficient animal glue stock in the world to meet the requirements for built-up wood. Furthermore, there is no possibility that the potential supply of animal glue would be adequate, no matter what the price might be.

The matter of strength in a glue is of fundamental importance. No matter how much money Vegetable Glue might save or how inadequate the supply of other glues, it would be useless if it did not make strong joints. This was one of the critical tests to which it was subjected in the initial days of the discovery. It measured up then, and it has done so ever since. Test block joints of Vegetable Glue resist a breaking strength under 1,500 to 2,500 pounds to the square inch. The tensile strength of dried films is placed by Dr. William M. Grosvenor, a prominent industrial chemist of New York, at 5,000 to 10,000 pounds. It has been repeatedly demonstrated that in veneer work the wood itself will break before the glue line will yield. Vegetable Glue does all that animal glue will do, and more. Its quarter of a century of successful service proves its strength, both literally and figuratively.

*Vegetable  
Glue  
meets  
the tests*

Then again, there is another requirement that a glue must meet. Better than animal glue, Vegetable Glue will withstand the changing temperatures and moisture conditions of variable climate. Humidity and dry heat leave it untouched. Vegetable Glue does not drink up water; it is not like a sponge or blotting paper. One of the most severe

tests to which furniture can be submitted is to be found in a New York City apartment. Here Vegetable Glue is adamant. Joints do not weaken. Indefinitely, furniture remains as strong and unyielding as when it left the factory. There is no type of climate to which Vegetable Glue work has not been exposed, and it has stood every test.

During this quarter of a century of service, Vegetable Glue has found application for a host of purposes. The list is a long one. A few of the items include household, office and hotel furniture of every description; pianos, book cases, sewing machines; cabinets for radios and talking machines; plywood; special interior paneling; veneered doors; game boards; box shooks and other articles almost without number.

*Glue and  
veneering  
eliminate  
waste*

A triumph of the veneering art in recent years is the built-up door. All doors are now laminated to some extent. The big "slab" doors of hospitals and public buildings are completely such, and other doors are veneered. A large proportion, probably eighty per cent, of the modern door is built from material that would otherwise be waste, little strips and short pieces. Then, the patchwork core is veneered. This method has revolutionized the manufacture of doors, both for public and private buildings. This achievement would have been impossible, of course, without a dependable glue. On this point, it is interesting to note the comment of a large door manufacturer, of Oshkosh, Wis-



consin, made in a letter to the Perkins Glue Company, written in 1929: "If you still retain your early records, you probably would find that our company was the first one to make a contract with you (in 1909) for the use of your glue in the door business in Oshkosh. We certainly have appreciated our business connections with you and the product which you have supplied us with. It has helped to build up more hardwood doors than we probably ever could have hoped to build by use of the hide glue formerly used and it is a pleasure for us to say that our working conditions have been very much improved due to the use of cold glue."

Still, the outstanding achievement of Vegetable Glue has not yet been told. It can be applied cold. That is easily said, and to the uninitiated probably means little. However, this is a most significant point. It means that the temperature of the glue room may be anything desired. The atmosphere may be as wholesome and sanitary as that of a drawing-room. Workmen may live during this vital portion of each twenty-four hours in comfort. If Vegetable Glue had done nothing else, it would well be worth all the cost—the years of trial and unremitting effort, the hardships and disappointment, and the ultimate denial to its inventor of the complete fruits of victory. The advent of Vegetable Glue marks a turning-point in the history of the art, the first in more than thirty centuries.

*Vegetable  
Glue  
wins  
a victory  
for the  
workers*

Important, too, are certain other working conditions. The

application of glue cold eliminates the necessity for hot cauls with the annoyance of greasing or waxing them. Blisters no longer occur. The cold glue does not deteriorate by standing. Even after several days it does not require reheating. It undergoes no bacterial decomposition, no souring. When once mixed, it requires little attention. The glue man does not need to be continually in fear that his batch will be either too thick or too thin. He knows, too, that the joints made with it will improve with age.

Two decades ago, when Vegetable Glue was in its infancy, Firman Kahrs, a well-known chemist and the publisher of a magazine entitled "*Glue*," declared, "Glues three—animal, vegetable and mineral! Yes, and every one the best for some purpose, while it is also possible to use any one of these three for the same kind of work. Take, for instance, veneering. Animal glue is there the old standby, thought to be *the* glue—the only glue—until Perkins showed what the vegetable adhesives could do."

*Twilight falls* Even with initial success and a bright future in sight, the load which Mr. Perkins was compelled to carry did not lighten. Rather, the burden seemed to grow. Overwork, worry, financial embarrassment, often real hardship—these were taxing beyond limit the powers of physical endurance. The road was still rough, and the main highway leading to prosperity lay just over the hill. Long since, the sun of life had passed the zenith, and late afternoon was



rapidly merging into the twilight shadows of early evening. In August, 1909, Mr. Perkins was taken ill, and in September of the following year he died, a young man, having fulfilled little more than two-score years of his allotted three-score and ten.

Thus, the curtain fell on a life of more than ordinary usefulness. But, as we shall see, the thing that Frank Gardner Perkins started lived after him, and it will continue to live far into the future.

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## CHAPTER VII

### *Carrying On*

THOSE were dark days following Mr. Perkins' death —yes, critical days for the infant industry of Vegetable Glue. Those interested in the enterprise were faced with the alternative of seeing others reap the benefits of the Perkins discovery, or someone must assume the responsibility of carrying forward the work so well begun. However, it was keenly realized that, without the intelligent guidance of those intimately associated with the origin and development of the process, this distinct advance in the art of gluing would, temporarily at least, be lost to the general public.

Fortunately, there were two individuals possessing the qualifications necessary to insure continued success. Mrs. Gertrude S. Perkins, the widow, had been through all these years the loyal co-worker of the inventor, his secretary and traveling companion. Although then without business experience, she was thoroughly acquainted with every phase of the development of Vegetable Glue. We have seen, too, that Mr. Stryker had been closely associated with the work of perfecting the product. Although a young man at the time, his intimate knowledge of the business fitted him,



better than anyone else, for the difficult task of supervising future operations. Accordingly, with Mr. Stryker as General Manager of the Lansdale plant and Mrs. Perkins in charge of the Sales Department at South Bend, the industry of Vegetable Glue moved forward to fresh conquests.

The unique feature of giving to customers the free use of the special machinery for applying the glue was a decisive factor in winning early success. This policy became the cornerstone of the new builders. Probably no outsider would have felt the confidence necessary for this bold stroke. It made converts to Vegetable Glue as nothing else could.

*A policy that inspired confidence*

In passing, it may be worth while to glance at one fact which time and again in the history of scientific discovery has come to the fore. In their initial work, it was the very ignorance of the inventor and his chief associate that possibly proved to be one of their most important assets. Bell once said that, had he known more about electricity and less about sound, he would not have invented the telephone. The chemistry of glue was a sealed volume to these two pioneers. Had it not been, this branch of the gluing art might still lie in the realm of future discovery. It is also of interest in this connection to know that Perkins and the man to whom fell the responsibility of establishing his work were in many respects the direct opposites of each other. It was the latter's native conservatism which fre-

quently served as a balance wheel to the inventor's overflowing enthusiasm and unbounded optimism.

Thus the industry came to be established. As time has proved, fortunate was Mr. Perkins in being able to leave the task of its development in such capable hands.

*Solving  
financial  
problems*

Financial difficulties, these have proved to be the rocks upon which many a promising industry has beat itself to pieces. For a time such seemed to be the most likely fate of Vegetable Glue. During the first three or four years, Perkins had no capital with which to back his enterprise. His only resource in those days was the assistance of some good friends in New York, who had sufficient faith in the prospects to loan money for the purchase of raw material, waiting for payment until the sale of the finished product.

*An appeal  
that did not  
fail*

It is a matter of justifiable pride to the present organization that the old Planters' Manufacturing Company never went into bankruptcy or even receivership, though many times perilously near the former. However, debts were always pressing. There were loans at the banks and open accounts payable, but Mr. Perkins, with that wonderful resourcefulness which was a chief characteristic even when the skies were darkest, managed to keep his creditors satisfied. His rugged honesty, which no one questioned, served him nobly in the hour of need. His strategy in the winter of 1904-5, when he had caught the vision of a new indus-



try to be built upon the ruins of the Florida debacle, reminds one of the crisis faced by Henry Ford in the early years of his pioneering in the motor field. It was just before Christmas, and there was no money in the treasury with which to meet the payroll. Ford called his men together and explained the situation, appealing to their sense of loyalty to save the industry from ruin. The men responded with a will, and, as all the world knows, Ford did not forget them when prosperity came. In like manner Perkins went to his creditors, telling them of his glue discovery and promising that all should be paid in full if they would not push him overboard. The response was a generous one, and the fulfilment of the promise has long been a matter of organization history. However, only a beginning was made in the lifetime of Mr. Perkins. His successors, Mr. Stryker and Mrs. Perkins, building upon the foundation which he laid, have erected a credit structure, staunch as the business which it serves.

The plan of Mr. Perkins to reorganize the Planters' Manufacturing Company into the Perkins Glue Company was carried out in November 1911. During the eleven years' existence of the parent organization, no dividends had ever been paid, nor even interest on some of the loans made to the company by friends. Accordingly, the old stockholders were taken into the second organization, being given one and three-fifths shares of new stock for each share of the old, the three-fifths share representing accumulated

and unpaid interest. In some instances, stock in the new company was taken in payment of debts. Thus, as the business prospered, the original loss in the ill-fated Florida venture was made good, and no person ever suffered from his association with Frank Gardner Perkins. As well as though he had lived to do it himself, did Mr. Stryker and Mrs. Perkins establish the financial security of his organization.

A factor which contributed largely to the foregoing success was the policy of putting service to the company's customers above profits. By methods already described, there was initiated and developed one of the most unique sales programs in the history of American business operations. Nothing short of perfect confidence in the satisfactoriness of one's product could induce an organization to make a capital investment of hundreds, and often thousands, of dollars in a customer's plant before it receives a dollar in return. Add to that a service staff which at all times offers expert advice and assistance, and you have a combination bound to win. And so it proved.

No account of the Perkins achievement would be complete which did not recognize the loyal co-operation through these years of the Company's staff of associates. To their unfailing interest and steadfast efforts is due much of the prestige of Perkins products in this and other lands. Despite the dehumanizing tendencies of this machine age, the personal factor still dominates in the building of our



industrial organizations. Today, no less than yesterday, personality is the keynote of big business. Without the sympathetic understanding and intelligent guidance of those all along the line, industries disintegrate; stagnation overtakes them, and eventually they decay. Particularly fortunate has the Perkins Company been in its staff of co-workers, for such they have been. At all times, the success of the organization has been their goal. As enduring as the joints which Vegetable Glue makes, is this spirit of wholehearted co-operation. It is kin to the pride of craftsmanship characteristic of the early masters of the veneering art. And so here we pay tribute, not alone to the inventor and to those upon whom fell the immediate responsibility for carrying on his work, but to the men in the ranks who, having caught the vision of a splendid achievement, have given their best of human skill and thought to its realization.

In one respect, the experience of the Perkins Company has paralleled that of many others in the field of scientific discovery and invention. When success had come and the pioneer days were over, rivals arose. To the work of carrying on fell the task of maintaining the priority claims and prestige of the Perkins discovery and product. As a tribute to the memory of Mr. Perkins, it should be said that Mr. Justice Stone of the United States Supreme Court in a decision handed down on May 14, 1928, declared that he was the first to make successfully a carbohydrate glue "suitable

*The courts  
concede the  
priority of  
Perkins'  
discovery*

for wood veneering and similar uses." Likewise, Mr. Gorham Crosby of the company's legal staff, after the examination of thousands of pages of testimony, has asserted that, until Mr. Perkins did it, there is not a shred of evidence to the effect that anybody ever satisfactorily glued together two pieces of wood with a Vegetable Glue. The simple truth is that in the early years the idea of doing this thing was the subject of open ridicule. Against it was marshalled the mimic artillery and ill-conceived criticism of intrenched conservatism. "Absurd," "visionary," "impracticable," and much more of a like nature were the denunciatory missiles aimed at the project. Then, with characteristic suddenness, it was discovered that the undertaking was none of these. As is often said, "nothing succeeds like success." A vision of profits began to gleam through the darkness. The opposition melted. And, lo, some there were who made bold to advance claims of prior discovery. But the verdict of the courts has set its seal upon the controversy. The credit that is Mr. Perkins' due is no longer open to question.

Thus did the logic of events bring Mr. Perkins' dream to pass.



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## CHAPTER VIII

### *The Java Plantation*

AS we have seen, cassava flour is the ideal raw material from which Vegetable Glue is made. We are acquainted, too, with the costly failure experienced in trying to produce this flour in Florida. Furthermore, nowhere else in this country does one find the conditions of soil, temperature, rainfall and general climate adapted to the culture of the cassava plant, the root of which is the source of the flour. It is a truly tropical plant and will not thrive in subtropical countries. However, the tropic regions do afford certain natural habitats. One of these lies in Java of the Dutch East Indies. There, the rich soil, the absence of frost at all times of the year and the abundant rainfall, distributed at just the proper seasons, combine to meet the precise requirements of cassava culture. Accordingly, in 1922, the Perkins organization established the Dutch East Indian Company and acquired ten thousand acres of land in Java for the cultivation of cassava. Eighteen months later a factory, consisting of fourteen different buildings, for the production of the finished cassava flour, was put into operation. Of interest, too, is the fact that between the time when Mr. Perkins and Mr. Stryker broke ground for the

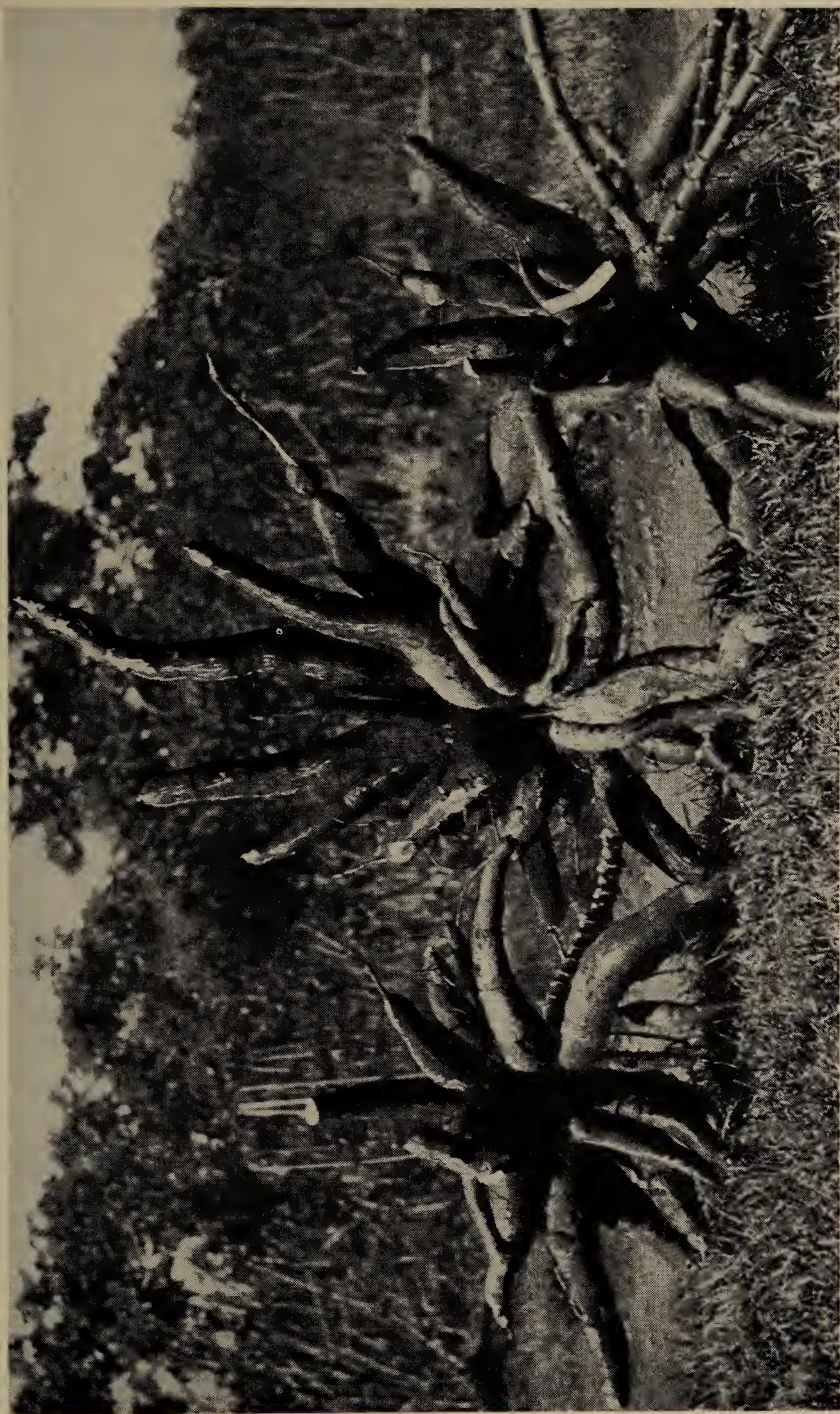
factory in Florida and the time when Mr. Stryker broke ground for the Java factory, twenty-five years, almost to a month, had elapsed.

*The pedigree  
of the  
Cassava  
Plant*

Now, just a word about the cassava plant itself. It belongs to the botanical family known as the Euphorbiaceae and to the genus *Manihot*, thus relating it to the Ceara rubber tree. Although varieties with single leaves are known, the leaves are usually palmate, being divided into from three to seven parts. The same plant produces both male and female flowers, which are arranged in loose plumes. The fruit, triangular in shape, contains three seeds. At the base of the trunk grow the stubby turnip-shaped roots in the form of clusters, the size and number varying considerably with the different varieties. Although two species, the bitter and the sweet, are usually recognized, many botanists regard the latter as simply a variety of the former. In Java the plant grows to an average height of ten to twelve feet.

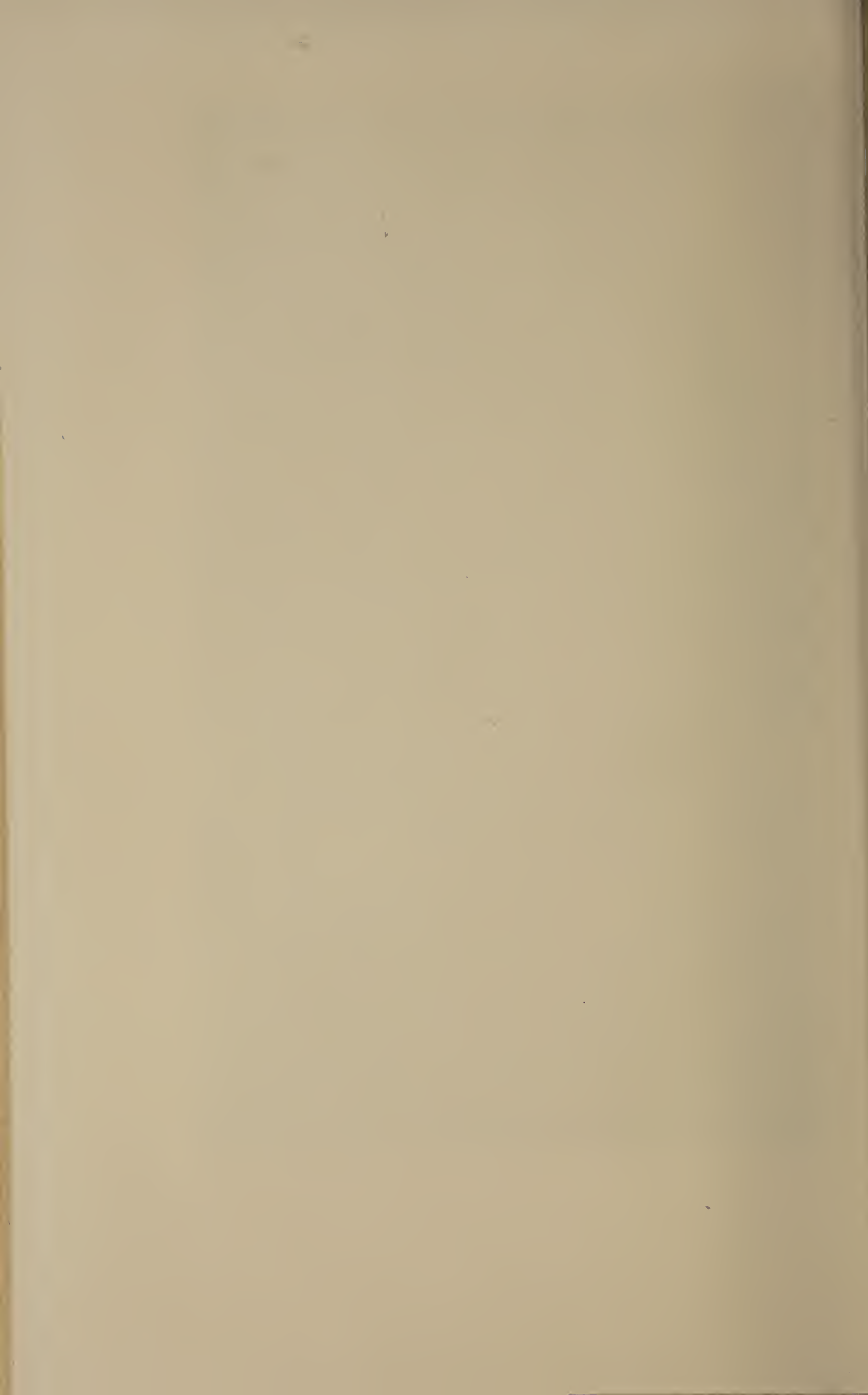
Cassava is said to be native to Brazil, whence it has spread to many other tropic countries. Its range includes a belt extending approximately to thirty degrees of latitude on either side of the Equator. The Portuguese were largely instrumental in transplanting it from Brazil to other parts of the world. Cassava was first planted in Java about 1850, and is generally believed to have been imported from the West Indies. Its cultivation gradually spread from West





*Cassava roots on the Java Estate*







Java to the central and eastern portions of the island. The factory production of cassava flour, as well as the domestic production by natives, has grown to be an important industry, more than three thousand laborers being employed in some of the factories and plantations.

The seed for planting is obtained from the top, or stalk, which is cut into pieces six or eight inches long for this purpose. The rows are spaced three feet apart in each direction to allow for proper cultivation, which requires considerable care during the first three or four months, the average growing period in Java being from fifteen to sixteen months for best results. A porous soil of loose structure and free from any standing water is an important requirement. In very fertile soil the plant attains a luxurious growth of leaf and stalk; however, this is at the expense of the roots, from which the cassava flour is obtained. The yield of roots varies, depending upon the variety, character of the soil, climate and cultivation. The usual range is from five to ten tons per acre, which may rise to seventeen tons.

The factory end of the industry, of course, consists in extracting the cassava flour. The initial step is to open the cell walls of the roots, which in Java is for the most part accomplished mechanically by power-driven machinery. A plentiful supply of soft water is a prime essential, and the roots should be freshly dug. The processes for the separation and preparation of the flour are similar to those em-

*Planting  
and  
cultivation*

ployed in a milling operation. They are not distinctive and will need no particular description here.

Aside from machinery for cultivating and harvesting and the factory equipment, the Dutch East Indian Company possesses twenty miles of railroad, distributed over its estate and leading thence to the ocean dock, where its product is loaded onto steamers for shipment to the Lansdale plant.

Thus has the quest for the indispensable raw material for the manufacture of Vegetable Glue carried the Perkins Company far afield.

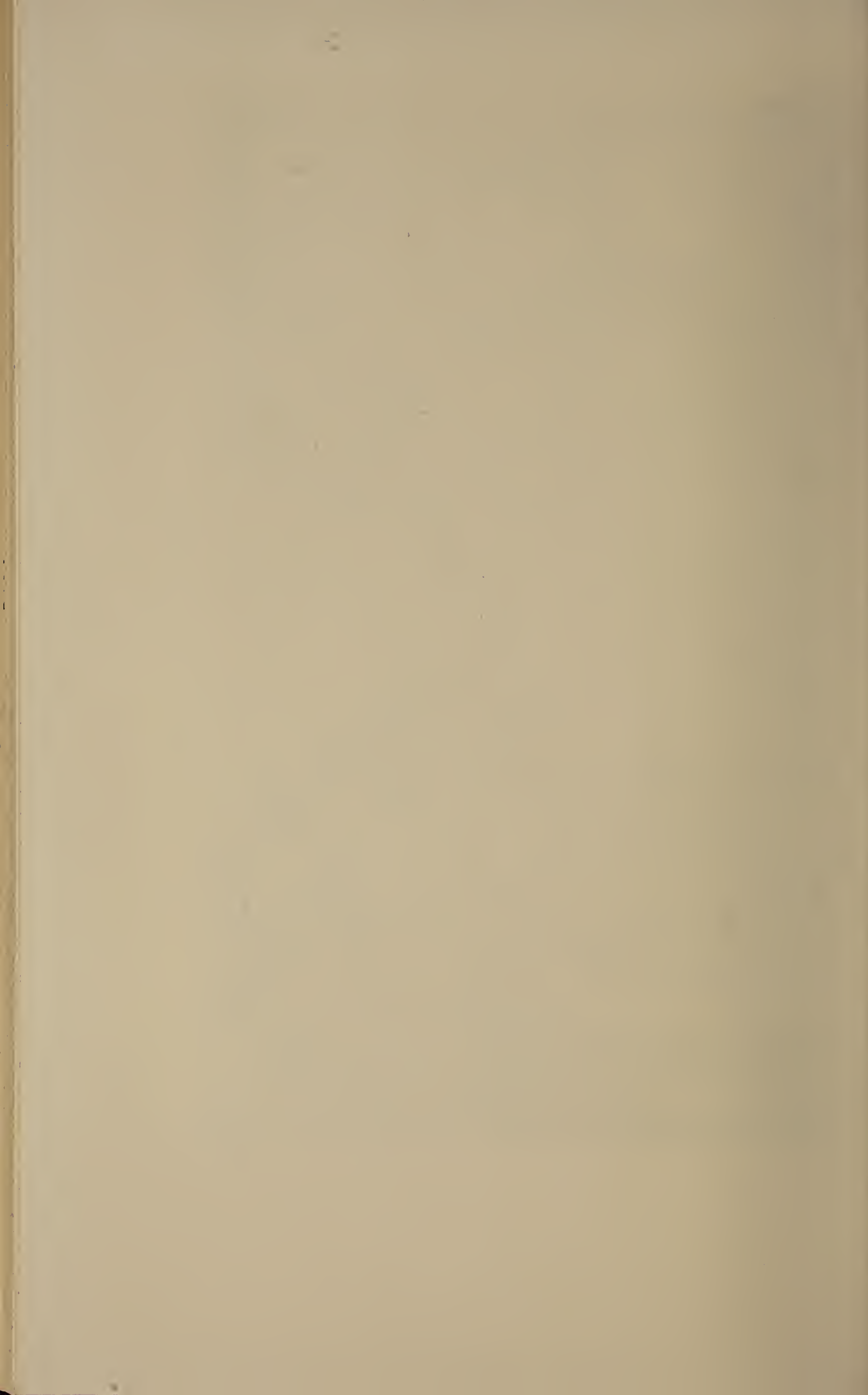
*An  
interesting  
ceremony*

In Java, whenever a new factory is put into operation, or before work in an old factory is started again each year, as well as when a new residence is to be occupied or an old one re-occupied, it is a universal custom among the natives to observe a time-honored ceremony, called the "Salamatan." The belief prevails that this rite is essential to bring good fortune to themselves, and to a lesser degree to their employer. If this ceremony is not observed, these superstitious folk fear the displeasure of the gods, with dire results for all concerned. If the employer is so unwise as to ignore for any reason their religious scruples in this regard, the natives are apt to contrive that something shall happen to him or his household or to his factory. For instance, stones may "accidentally" get into the grinding machinery. However, a much more potent factor than the fear of the





*Enjoying the feast of the "Salamatan"*





gods in determining the insistence with which the ceremony is demanded is the desire for the feast which accompanies it, furnished of course at the employer's expense. This feature, at least, is never allowed to be overlooked.

Without realizing it, Mr. Perkins and his associates were pioneers in a new field of chemical industry. In composition, cassava flour is kin to cellulose, which is rapidly becoming a name to conjure with. For we stand today upon the threshold of a vast new age of cellulose, comparable to that of coal tar a half century ago. As many of you know, the energy of sunlight, in those marvelous chemical laboratories in the living cells of green leaves, takes the carbon dioxide breathed in from the air and the water drawn through the roots and builds them into the woody fiber of the plant. That woody fiber is cellulose. It is at once the most abundant and the most mysterious vegetable product of this planet. It antedates human history by many millions of years, for it was from cellulose that Mother Nature fabricated coal, the chief fuel of the present age. With sticks of cellulose our primitive ancestors kindled their first fires; with weapons of cellulose, in the shape of wooden clubs and bows and arrows, they fought their first battles; with implements of cellulose they tilled the soil; as grain and cereals, it provided them with food. In the form of linen and cotton, cellulose has afforded for centuries two of the chief fibers of the textile world. As papyrus and

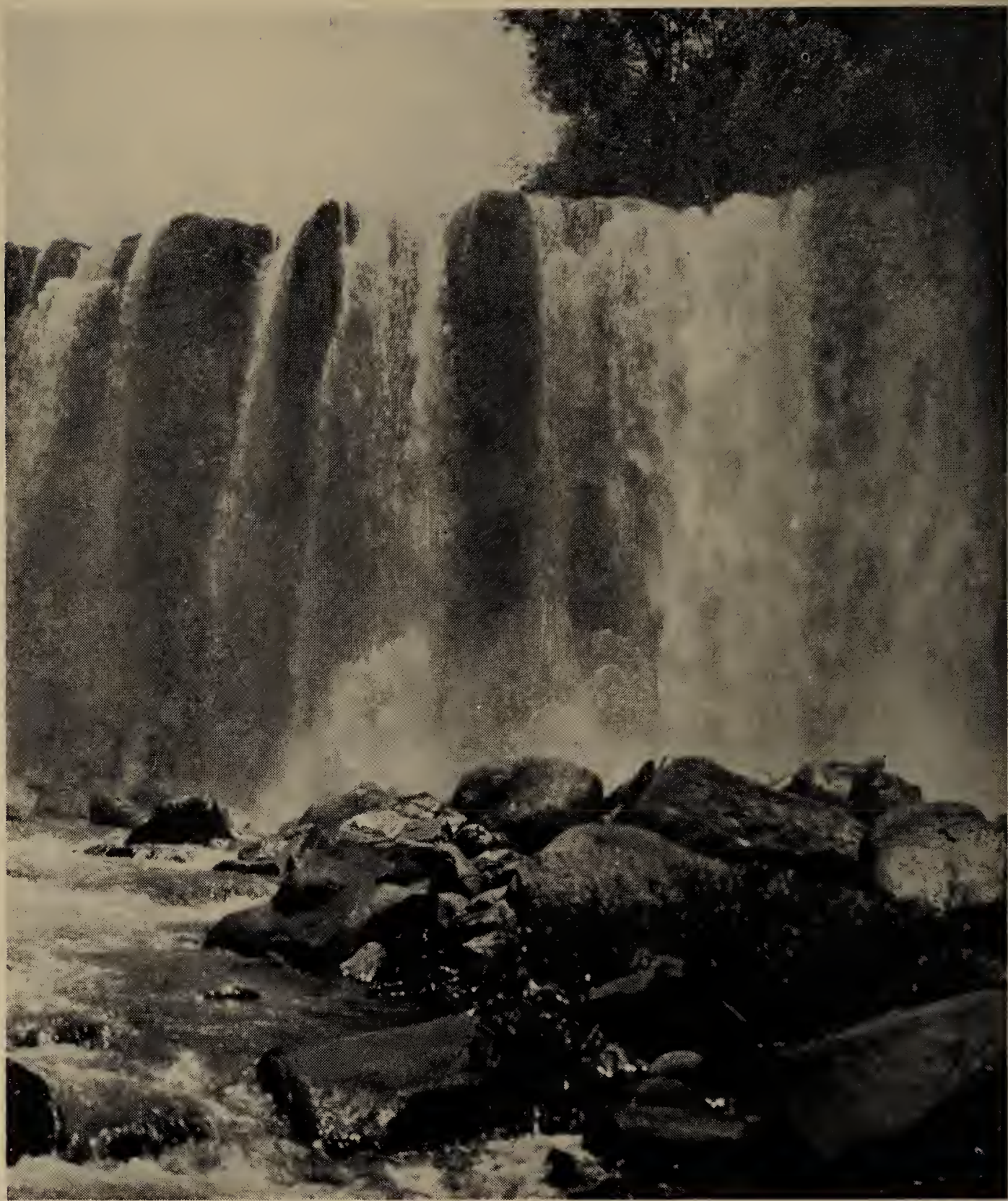
*Cassava  
culture a  
part of the  
Cellulose  
Romance*

later in paper, it has served the civilization of mankind from time immemorial. And today in the guise of celluloid, nitrocellulose, lacquers, rayon, artificial leather and the host of by-products now being obtained from cornstalks, cottonseed hulls and other farm wastes, cellulose is meeting a multitude of needs. It is becoming a factor of tremendous importance in chemical industry.

As a veteran in the ranks of this later movement stands Vegetable Glue. It constitutes one of the many outstanding uses of this new resource of chemical wealth, and its inventor was a prospector, who by accident blundered into a rich field of vast possibilities.







*One of three waterfalls on the Company's plantation in Java*



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## CHAPTER IX

### *In the Lansdale Plant*

WHEN you place a beautiful piece of veneered furniture in your home, made everlasting through the mediation of Vegetable Glue, in all probability you never give even a passing thought to the multitudinous details whereby this modern adhesive is made ready for the craftsman's art. From the sowing of the seed on the Java plantation, through the factory preparation of cassava flour and its long journey overseas and by rail to the Lansdale plant, where the finished product is manufactured, scientific control is on guard at every point of the industrial compass. In particular is this true at Lansdale. There one sees an outstanding example of applied science in modern industry. That plant and its equipment, together with what is done there, stand for the concrete realization of an inventor's dream. It was with the keenest interest, inspired by a knowledge of the long struggle and partial tragedy of the early years, that the writer of this story visited that spot. To him it stood as a symbol of a quarter of a century of splendid achievement, the happy outcome of a farseeing vision, buttressed with hard work, practical sagacity and rare business ability. Emerging from the discoveries worked out

there, he beheld, too, a new era in the ancient art of fabricating veneered furniture. The scene before him marked a turning-point of strategic importance in the centuries-old journey leading from the handwork in the workshops by the Nile to the machine-made output of this highly mechanistic age. The operations observed there are prosaic enough. It is only when one sees them silhouetted against the historic background of more than thirty centuries of stagnation in the gluing art that he catches a glimpse of what this discovery means. And so, with thoughts of this kind passing through his mind, the writer moved from operation to operation, every now and then trying to picture how the craftsmen of the Pharaohs would have contemplated this innovation. If you wish, you, too, may make the visit. Shall we not do so?

*A survey  
of the  
operations*

As one might suppose, our guide takes us first to the warehouse, where immense quantities of raw material, direct from the Java plantation, are held in storage. We seem to be in the presence of enough potential vegetable adhesive to glue up all the furniture of a host of factories for years to come. Yet, we are told that, when running to capacity, this large store is exhausted in a few weeks, a striking commentary upon the place which this glue has made for itself in the furniture world. The original plant was built for a capacity of 9,000 pounds a day of "Perkins 183." A little later, with a working day of sixteen hours and two shifts of



men, the output rose to 60,000 pounds, and eventually with a working day of twenty-four hours to twice that quantity. As the business grew, the size of the plant expanded to meet the increased need.

In one end of the warehouse we come across row on row *A* and tier on tier of what look like some sort of specimens. *unique* We begin to wonder if we may be approaching a museum. *record* Our guide, however, tells us that these are samples representing work which has been glued in the laboratory and tested. Every batch of glue is tested in this way and the record kept. These records go back to the very beginning of the Lansdale operations. It is something like the fossil record of the rocks. No glue is ever shipped without being tested and the results filed away in this manner. Attached to each sample is the tabulated data for future reference. It is a wonderful tale of strength and durability that these records preserve.

We now cross over to the factory proper. At one point on the ground floor workmen are busily engaged in opening bags of cassava flour and discharging their contents on to a conveyor, which transfers the white powdery stuff to a wooden tank. Without knowing it, these men are taking the initial step in a process which may find its sequel in a work of art to be seen in some museum a thousand years hence. However, they see only the raw material. The romance of the thing never comes within their vision.

In this huge wooden tank a mechanically operated agitator keeps the cassava flour suspended in water, forming a liquor, which is pumped to other tanks on the second floor. There chemicals are added to produce certain desirable changes, and the liquor is kept at this point for a period of time, varying with the sort of product being prepared. It ranges from twenty-four to seventy-two hours. The quantity of chemicals used also varies.

The next step is to concentrate this chemically treated liquor somewhat and then centrifuge it. The centrifuge, working on the same principle as a centrifugal clothes-drier, removes sufficient water to enable workmen to take the material out in cakes, containing about thirty-five per cent moisture. Conveyors carry the product to a series of mechanical feeders, which thrust it into huge driers. Here, in heated kilns, the moisture is driven out and carried away by suction fans. The dust moving along with this moist air is mechanically separated and used over again.

Somewhat to our surprise the guide tells us that the product coming from the driers is finished Vegetable Glue, ready for testing and subsequent use. The process has seemed to be exceedingly simple, and, indeed, it is not complicated. Nevertheless, although now reduced to routine methods of procedure, as we have seen, this simplicity was long in being discovered. Following the first accidental discovery came months and years of patient investigation. As with many another invention, Nature yielded her secrets tardily and









*In the testing laboratory at the Lansdale plant—insuring the quality of Perkins products*



reluctantly. But yield them she eventually did, and because of it Vegetable Glue for a quarter of a century has been filling the niche waiting for it from the beginning of civilization.

An industry which does not keep abreast of scientific research may wake any morning to find itself on the scrap-heap. This fact is written large in the record of recent events in the industrial world. Dr. John E. Teeple, a leading chemical engineer of this country, told a group of New York bankers not long ago that he cared much more about knowing the attitude of a board of directors toward scientific research than he did to know the assets of their balance sheet. Sound research is the most important asset of any industrial organization. Even in advance of its general acceptance, the Perkins Company had long made this principle a fixed method of procedure. The laboratories are a conspicuous feature at the Lansdale plant. Let us step inside them for a moment.

In one laboratory we see test kettles. They are as nearly as possible exact duplications of the big factory kettles used by the customers of the Perkins Company. The strictly chemical tests, made elsewhere, are important. However, they are more general and fundamental in their bearing. They look toward the future and the discovery of deep-seated secrets of Mother Nature, possibly of revolutionary

*The  
laboratories*

*Insuring  
the quality  
of Vegetable  
Glue*

significance. On the other hand, the tests carried out in this laboratory are of more immediate importance. They are highly practical. Here each batch of glue, before a pound of it is shipped, is subjected to tests as exacting and rigid and as nearly like those prevailing in the customer's plant as it is possible to make them. Nothing is ever taken for granted. Merely because the glue of today is being made in the time-honored and accepted way, it is not assumed that the product needs no preliminary examination. As the years pass, these tests become more elaborate and refined. They are in large measure the secret of Perkins success. Laboratory control at every step of the way, today no less than yesterday, continues to lay the foundation upon which the industry rises and expands.

After being heated in the kettles to the proper temperature for a certain period, the glue is tested in especially designed machines for viscosity, or body. If this property of fundamental importance meets the requirements of the art, the batch from which the samples were taken is passed, up to this point. Then comes the testing of joints. Although there is not one chance in a hundred, or probably a thousand, that Vegetable Glue, when properly manufactured, will fail to make a perfect joint, this test is never omitted. Units, each consisting of two wooden blocks one square inch in cross-section, are laid up and allowed to dry. Then each unit is tested in a rather formidable looking machine to determine the number of pounds of pull per square inch re-



quired to break the joint. Samples lying before me as I write prove that in almost every instance the wood itself breaks before the glue line yields. For a quarter of a century, Perkins Glue has been successfully meeting this requirement.

Other blocks laid up with a particular batch of glue are subjected to what is known as the "shear test." In this test the blocks are pushed, rather than pulled, apart. In a shearing machine, the attempt is made to slide one block on the other, along the glue line. Here again Vegetable Glue exhibits a wonderful degree of strength. Such tests as these are eloquent in their refutation of the unfounded aspersions cast upon Vegetable Glue in its early years by those who always look with suspicion, often mingled with envy, upon any innovation, particularly if it gives promise of becoming any sort of rival.

When a batch of glue satisfies the watch-dogs of the testing laboratory, and not before, it is certified for shipment to the veneering trade. Had these tests been omitted from the Perkins' program, Vegetable Glue might long since have gone to smash on the rocks of industrial distress. Certain it is that without them the high grade and uniform quality of the Lansdale products could not have been maintained.

*Perkins  
products  
must satisfy  
the watch-  
dogs of the  
laboratory*

In another laboratory one finds in progress experiments with casein glue. While Vegetable Glue, long standard for

most uses, constitutes the chief output of the plant, the Perkins Company recognizes that for occasional specialized purposes casein glue may be preferable. Here one may see test blocks which will not yield along the glue line even after twenty hours of soaking in water. Although the Company now puts on the market some six or eight highly successful casein glues, laboratory research, here as elsewhere, is the constant guide toward future improvement.

At still another point we come upon the chemical laboratory proper, with its familiar array of test tubes, flasks, retorts, heating units, reagent bottles and other equipment. This sanctum has long been a proving ground for Perkins' products and a source of discoveries vital to the progress of the industry. To neglect it would be suicidal to future growth, and this the Company has long recognized. To this day the spirit of experimental inquiry which constantly guided Frank Gardner Perkins has remained the dominating factor in the work of the organization which he founded. In very truth he builded better than he knew.

*Interesting items* In the engine room one sees a pump which brings water, free from surface contamination, from a depth of 200 feet in the solid rock. Its temperature, summer and winter, invariably stands at 55 degrees Fahrenheit.

A "Permutit" water-softening plant provides water of zero hardness for boiler use. However, the water for the glue processes needs no treatment. The company provides





*A glimpse of the Perkins chemical laboratory*







its own fire protection, having an equipment adequate to meet any probable emergency.

Machine and carpenter shops meet a multitude of needs. The plant is replete with equipment for every ordinary requirement. Like a huge organism, its various parts function perfectly, spelling economy of effort and efficiency in operations. They are the outgrowth of many years of well-planned building, in literal truth a dream fulfilled.

The Perkins products are many and varied. The brands, by actual count, number thirty-one, somewhat short of the proverbial "57," but nevertheless a respectable number. From furniture glue of every sort to liquid paste, sheet-metal glue, linoleum cement and core filler, not to mention other products, one would find it difficult to name a need of the gluing art which the products of the Lansdale plant do not meet. A quarter of a century of intensive research in this field has left little to be desired. Nevertheless, today more than ever in the past, continued research is the watchword of the future.

And so the visit to the Lansdale plant draws to a close. To one interested in this field of manifold usefulness, it has been a highly illuminating and profitable visit. To an unusual degree we see illustrated here the methods whereby modern industry is becoming the product of applied science.

From those workshops by the ancient Nile and the crude *An*  
beginnings of primitive men, we have traveled a long jour- *afterword*

ney. On the way we have hobnobbed with royalty, sat in the seats of the mighty and caught glimpses of the workshops of great craftsmen. Genius, art, romance and skilled artistry have freely mingled in this pageant of the centuries. In the crucible of an ancient art, the contributions of these varying factors have been crystallized into masterpieces of enduring truth and beauty. Faithfully do they delineate the progress of successive generations of human beings, ever striving toward a goal which is never reached. But it is well that it should be so. Perfection would mean stagnation. Any imaginary state of delightful equilibrium would be suicidal to future growth. The objective must be always with a forward-moving vanguard. This is the keynote in every field of human endeavor. It always has been so; it always will be so.

For the moment we write "finis" across *The Story of an Ancient Art*. However, let no one imagine that the final chapter has been written. Tomorrow may see advances carrying the world forward on a veritable flood-tide of fresh progress. And whatever may be the fortunes of the veneering art, the stability and permanence of its products, then as always in the past, will be fundamentally related to the quality of the adhesives used.





